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WHO WILL LEAD FOREST RESEARCH?

Research in forestry is gaining recognition. Scientific organizations are beginning to take an increasingly greater interest in forest problems. Foresters are coming more and more in contact with the men of older professions. Both unconsciously and consciously comparisons come to mind whether we foresters measure up as scientific workers to the standards of other scientific men; whether our task is to apply the scientific results of others to our specific problems or whether we can develop our own scientific methods and a science of forestry.

This is more than a mere academic question. Research in forestry is evidently needed. Who shall do it? Foresters or plant scientists? On the biological side, forest trees are, of course, plants and any fundamental investigations in silviculture lead you inevitably into the field of plant physiology, and further into bio-chemistry and biophysics.

Should forest research in this country be led by plant physiologists, bio-physicists, bio-chemists, or by foresters? There is only one answer and it is very simple. If forestry is to retain its identity as a scientific profession, foresters must become leaders in forest research and not depend on other scientific groups to work out for them the fundamentals. This does not mean that forest research workers should become specialists in chemistry or physiology. Specialization has reached, now, such a stage in science that co-operation of different specialists is a necessity in attacking any fundamental problem.

Co-operation, however, does not mean dependence. Into this co-operation foresters must bring original ideas of their own, suggest methods of approach, and check the accuracy of results.

Without becoming specialists in bio-chemistry or plant physiology, although there may be room for some in these fields, they must have sufficient knowledge of these branches so as to understand what are the essential elements in the problems. Above all, their knowledge of the forest situation must serve as a directive force in calling attention to the problems in need of solution.

Fundamental investigations should be measured not by the degree to which basic sciences are called in for the solution, as by the degree to which they answer the fundamental need of the people. No study, no matter how deeply it goes into chemistry or physics, unless it answers a fundamental need of our time can be considered fundamental.

Forestry, therefore, offers a distinct field not only for the application of scientific results worked out by specialists in other fields but for building a science peculiarly characteristic of forestry alone.

Without foresters taking a hand in the solution of the fundamental forest problems there is no hope that they will be solved by other scientists any more than bacteriologists, physicists, chemists, and X-ray specialists can alone solve the problems of medicine. These scientists can help, but alone they can not build a science of forestry.

FOREST OPERATION WITHIN FORTY-FIVE MINUTES OF BROADWAY

By Edward Richards
Consulting Forester, New York City

In the fall of 1920 a lumberman offered the owners of Saxton's Woods near White Plains in Westchester County, New York, $5,000 for all of the timber on the area 16 inches and over in diameter on the stump. The offer came with something of a pleasant surprise to the owners. Saxton's Woods was part of the estate of a Mr. Faile who had died some time previously. Some fifty odd heirs owned varying shares in the property and only a short time before had vested the right to handle it in one man, Mr. U., a New York lawyer. Mr. U. had the responsibility of taking care of the property, including paying the taxes. There were no houses on the property, nor was there any source of income from it. The problem of taxes was therefore a difficult one. It was known that the land was very valuable for real estate purposes as it lay within the suburban commuting district of New York City. Large sums of money, however, would have to be spent on building roads, putting in sewers, laying water mains, etc., before lots could be sold for building purposes. Such money was not forthcoming and to all intents and purposes Saxton's Woods was a frozen asset, a white elephant on the hands of the owners, potentially a very valuable white elephant, but still a white elephant. Under such circumstances it was difficult to raise money with which to pay the taxes and the whole situation was far from satisfactory. When the lumberman's offer came, therefore, it aroused interest in the possibility of making some profitable use of the timber, always with due regard to the real estate value of the property.

As Mr. U. was not familiar with the handling of forest land there were a number of questions which arose which he was unable to answer. What was the make-up of the forest and what condition was it in? What treatment was needed to maintain and, if possible, increase the value of the forest? Should any of the timber be cut? If so, how much, and would the lumberman's offer to cut everything over 16 inches in diameter on the stump correspond to the treatment which should be given the woods? If the lumberman's offer was inadequate either in treatment of the forest or in financial return, what other practical treatment could be applied and what financial return could be

expected therefrom? Faced with these and similar questions, Mr. U. decided that he needed expert advice and applied to the Yale Forest School for assistance. The School gave him the name of the writer and an arrangement was made for a "look-see" examination of the tract. This brief visit to the property showed clearly that the timber was almost entirely oak, that it was of large size for the region and that a more careful, systematic cruise should be made before satisfactory answers to questions as to what ought to be done in handling the property could be given.

In due time a careful cruise was arranged for and carried out, and a report submitted along the following lines:

Location and History: The tract is located just west of Rosedale, in Westchester County, New York, and lies about half way between White Plains and Mamaroneck on Mamaroneck Avenue, and about three and one-half miles from each place.

The property was formerly the woodlot of a farm. About 90 years ago the forest had been cut clean and since that time had been left untouched by the axe except in comparatively recent years when a part of the blight-killed chestnut was removed. As the value of the open land of the farm increased it was divided up and sold for suburban residences, until only the forested and swamp part of the farm remained. At present the total area of Saxton's Woods is 232 acres, of which about 217 acres is in forest and 15 acres is in open, swampy land and fields.

Surrounding Region: The country around Saxton's Woods is typical of Westchester County, New York. Moderately rough topography for a non-mountainous region predominates. Rough outcrops of mica schist make up most of the hills and ridges, many of which are thickly wooded with typical southern New England mixed hardwood forest. Cleared land probably does not occupy more than 40 per cent of the land area as a whole. While the region is hilly, variations in elevation rarely exceed 500 feet. Streams, springs, ponds, lakes and artificial reservoirs are found everywhere, but there are very few large marsh, bog or swamp areas.

There are a few "dirt farmers" but the vast majority of the rural population are either wealthy gentlemen farmers or suburban commuters who go in to New York City to business daily.

Transportation: Transportation systems are excellent throughout most of Westchester County. The New York Central Railroad runs along the Hudson River on the western edge of the county and

east of this line the Harlem branch of the same railroad runs up the Bronx River through White Plains. On the southeastern edge of the county the New York, New Haven & Hartford Railroad passes through Mamaroneck, and the New York, Boston and Westchester Railroad, which is owned by the New Haven road, runs between the latter and the Harlem branch of the New York Central.

In addition to railroads, the roads of the county are practically all hard bituminous-bound macadam or concrete. This makes the trucking of heavy loads of forest products practical. Mamaroneck Avenue is a fine, wide, concrete road, while the Saxton's Woods road is bituminous-bound macadam. The former passes close by the forest of Saxton's Woods and circles around on the east of the property a short distance away, to where it joins Mamaroneck Avenue. Woods roads at frequent intervals pass through the tract and in various places, wherever needed, these can be joined with the hard public highways by slabbing over soft spots, making temporary wooden bridges, or by other simple means.

The Forest: The forest contains the following species of trees:

1. Red oak.....*Quercus rubra*
2. Black oak.....*Quercus velutina*
3. Pin oak.....*Quercus palustris*
4. Scarlet oak.....*Quercus coccinea*
5. White oak.....*Quercus alba*
6. Chestnut oak.....*Quercus prinus*
7. Chestnut .....*Castenea dentata* (nearly all dead)
8. Yellow poplar.....*Liriodendron tulipifera* (whitewood)
9. Sycamore .....*Platanus occidentalis*
10. White elm.....*Ulmus Americana*
11. White ash.....*Fraximus Americana*
12. Beech .....*Fagus Americana*
13. Black birch.....*Betula lenta*
14. Grey birch.....*Betula populifolia*
15. Hard maple.....*Acer saccharum*
16. Soft (red) maple.....*Acer rubrum*
17. Flowering dogwood.....*Cornus Florida*
18. Hop hornbeam.....*Ostrya Virginiana*
19. Blue beech.....*Carpinus Caroliniana*
20. Black cherry.....*Prunus serotina*
21. Pitch pine.....*Pinus rigida*

22. Shagbark hickory.....*Hicoria ovata*
23. Pignut hickory.....*Hicoria glabra*
24. Sassafras .....*Sassafras sassafras*
25. Butternut .....*Juglands cinerea*
26. Black locust.....*Robinia pseudacacia*
27. Black gum.....*Nyssa sylvatica*
28. Red gum.....*Liquidamber styraciflua*
29. Red cedar.....*Juniperus Virginiana*
30. Swamp cottonwood.....*Populus heterophylla*
31. Basswood (Linden).....*Tilia Americana*

Of these species the following make up the commercial stand of the forest:

Red Oak (including red, black, pin and scarlet oaks)	68% by volume
White Oak (including white and chestnut oaks)....	12% by volume
Yellow Poplar.....	10% by volume
Chestnut (dead).....	6% by volume
Others	4% by volume
	100% by volume

Forest Types: There are three types of forest:

1. Swamp
2. Stream bottom
3. Upland

1. Swamp Type. Located in small pockets among the rocky ledges, this type is found on a wet soil, often with stagnant water except in very dry weather. The principal species are red maple, black gum and pin oak. In general the trees are of small diameter—less than 12 inches d. b. h. Maple often is found there in sprout clumps of two to six on one stump, often hollow-butted and stag-headed. Black gum is smaller than the maple. Pin oak is usually found with a swelled butt. The type is little damaged by fire owing to the wetness of the site. It has a small yield of merchantable material composed mostly of cordwood and a little low grade lumber. As a type the swamp is of little importance and covers only a small part of the forest.

2. Stream Bottom Type. This is found along streams where there is plenty of moisture, but also good drainage. The principal species are white ash, yellow poplar, white elm, black gum, sycamore and red maple. On this type the height growth is excellent. The diameters, however, are only medium-sized—not often over 16 inches d. b. h. The ash begins to die earlier than the other species, although

the maple seems to be the most liable to damage and is the most often injured at the butt. This type is only found along narrow strips bordering the streams and evidently is dependent upon them for water. The yield per acre is moderate in lumber, owing to relatively small diameters, but the yield in cordwood is good. The type is of value but there is not acreage enough of it on the tract to make it important.

3. Upland Type. This is the third type of forest on the tract and is of the most commercial importance as it contains the bulk of the merchantable stand. There are three qualities of site on this type varying from the deepest well-drained soil (the pockets of richest soil which are not swampy) to the shallow, rocky ridge tops. The principal species are red, black, white, scarlet and chestnut oaks, the chestnut, the yellow poplar and the hard maple, hickories and basswood. The best tree growth on the tract is on this type. Maximum d. b. h., 35 inches. Maximum total height, 100 feet. The average d. b. h. equals 14 to 16 inches and the average total height is 75 to 80 feet. The trees are both sprouts and seedlings. The maximum stand, actually measured, was 35,000 board feet per acre. The average stand was about 8,000 board feet per acre. Much of the stand on this type is over-mature and there is a very high percentage of damage from fire, fungus, windfall and wind break. Wherever light reached the forest floor in suitable degree, the reproduction is good. Much of this is killed, however, before reaching one inch in diameter, by the surface fires which burn through the forest nearly every year. These fires also do a great deal of damage to the standing timber by killing the bark of the trees near the ground. Fungus then has an opportunity to enter and decay begins, resulting in weakening of the tree at the butt, its being broken and blown down by the wind and finally its rotting on the ground.

Markets: Owing to the location of Saxton's Woods, its proximity to White Plains and to both the New Haven and New York Central Railroads, and to the fact that most of the material to be removed is oak, the market situation is excellent. The good motor roads to New York City and intermediate points also add to the possibilities and no difficulty should be experienced in disposing of all material manufactured.

The principal products manufactured will be lumber, railroad ties, telegraph poles, cordwood, slabwood and sawdust, all of which can be sold readily.

Recommended Treatment:

1. Although it has been realized that the chief value of the land is for real estate purposes, the fact that the presence of the forest greatly increases the value of the property as real estate has not been adequately appreciated. The careful, systematic examination and estimate of the forest on the property makes it clear that regardless of the value of the timber itself, any clear cutting of the timber is not to be considered. This eliminates the offer of the lumberman for the reason that the cruise of the timber shows that the greater part of the trees fall into the class of trees which he would cut.

2. The condition of the forest is such that a cutting is greatly needed. Repeated ground fires have damaged the butts of many of the trees, following which decay has taken hold, making it necessary to cut such timber. The chestnut blight has killed all of the chestnut, much of which can still be sold if cut at once. The forest is too dense in many parts, needing a thinning which will benefit the trees which will be left standing. Finally, the removal of part of the trees will improve the appearance of the whole property and so increase the real estate value.

3. The large size of the trees and the large amount of material available, together with the closeness of the tract to markets, make a partial cutting financially possible provided a large enough amount of timber is removed. It is recommended that such a partial cutting be made, removing 70 per cent by volume of the living timber and all of the dead and down material for which a market can be found. Such a cutting will take out all the dying trees, rotten butted trees, crooked and badly formed trees and such other trees as should be cut to open up the stand and to remove over-mature specimens.

4. Such a cutting as recommended above will not only improve the appearance and condition of the property but will result in a considerable financial return to the owners from the sale of the material removed.

5. The proper performance of the work recommended above demands expert labor and technically trained professional direction and supervision.

6. The writer will be glad to undertake the work of putting the above recommendations into effect on the property.

This report aroused interest among the owners, and the writer was asked to attend a conference to discuss arrangements as to the possibility of doing the work. This he did, bringing with him Mr. S.,

who was a lumberman of long practical experience, great energy and sterling integrity. Mr. S. and the writer had known each other for many years and had cooperated in forest work before. At the conference the details were thrashed out and the decision reached to proceed with the actual work in the field, after a suitable contract had been drawn up, which was done under the direction of the writer. This contract adopted the general plan recommended by the writer as set forth above, with the following major changes and conditions:

1. Only 50 per cent of the live timber was to be cut instead of the recommended 70 per cent.

2. All reasonable efforts were to be made to complete the whole operation in eighteen months.

3. The owners were not to advance any cash. Whatever was needed to finance the operation until the receipts from sales were sufficient to maintain the work was left to the lumberman to arrange for.

In addition to the primary object of realizing some cash from the forest, the objective of the cutting was to clean up the forest, cull out dead, injured, over-mature and dying material and put the forest into healthy condition, at the same time striving to improve its appearance in order to increase the value of the property for real estate purposes. This object was to be attained by removing the timber to be cut in such a way that the trees left standing would be evenly scattered over the land with as few large openings in the forest canopy as possible. Such a cutting would closely correspond to a heavy seed cutting under the Shelterwood System in technical forestry language.

Methods of Operation

1. *Marking:* For the first day or two of the marketing the writer attempted to mark the required 50 per cent without a complete tally of the d. b. h. of the trees. His method was to go in and mark as he judged the forest needed it regardless of measurements. Three or four times during the day, however, he would take a test tally of 25 to 50 trees, tallying their d. b. h. and separating those marked from those to be left. No system of selection was used here, all trees 12 inches or over d. b. h. being calipered and tallied as the caliper man came to them. It was found, however, that this method would not do. The test tallies showed that the natural judgment of the writer caused him to mark from 60 to 80 per cent to come out. As this was not in accord with the restrictions laid down by the owners, it was necessary

to change and the following method was adopted and adhered to for the remainder of the work in the forest.

The writer examined each tree as he came to it, deciding whether it should be cut or left. If it was to be cut, he blazed it at breast height with a belt ax. The attempt was made to keep all of these "sight" blazes on the same side of all trees marked—say the north. This enabled the fallers to see at a glance which trees were to come out by looking toward the south. The caliper man followed after the writer and measured the d. b. h. of all trees—both marked and unmarked, calling out the figure, to the nearest inch, to the writer in the case of each tree. The writer then tallied each tree under d. b. h. and "Marked" or "Left" as the case might be. The caliper man then blazed the butt of the trees, which had been marked with a "sight" blaze, stamping E. R. on the exposed wood with the raised initials on the back of the ax head. Care was needed to see that this stump blaze was low enough down to be below the place where the fallers would cut the tree, and to see that the stamping was done on the exposed wood itself and not merely on the inner bark of the tree. It was found that a clean, clearly readable mark was best obtained by a comparatively light blow with the back of the ax. In this way a 100 per cent tally of the trees above 12 inches d. b. h. was obtained, divided into "Marked" and "Left" columns. At the end of the day's work, a check-up was made on the relative per cent of material marked to material unmarked. This comparison was by volume. It was assumed that over the whole tract the heights of the trees of saw-timber size were equal, and therefore the volumes would vary approximately as their basal areas. As all diameters were taken at breast height, d. b. h. measurements were used as a basis for obtaining these basal areas. Beginning with one of the two columns—say the "Marked" column, the writer looked under the lowest diameter class tallied—12 inches—and counted the total number of 12 inch trees that had been marked that day. He then looked in a table showing the number of square feet in circles of various diameters (which were in inches) and found the basal area in square feet of a tree whose d. b. h. was 12 inches Multiplying this by the number of such trees in the "Marked" column, he arrived at the total basal area in square feet of all 12 inch trees which had been marked. He then worked out the basal area for the 13 inch, 14 inch, etc., classes until he had completed the "Marked" column. Adding up these total basal areas, he found the total number of square feet in the basal area of all of the trees marked for removal on that day. A similar process was then followed to ascertain the total basal area of the

trees in the "Left" column. Finally, a comparison between the two totals showed what per cent, by volume, of the trees had been marked for cutting.

As the figures rarely, if ever, came out exactly right—50-50 per cent—the totals were carried over from each day to the next, under each of the two columns. As time went on, therefore, the writer, by watching these accumulating totals, was able to mark more severely or less so, as occasion demanded.

It was found that in the actual marking and calipering of the trees, different workmen made changes necessary in the routine. Sometimes the marker was slow or inaccurate in calipering or in reading the calipers. Again a man might be good at calipering but slow with the ax. It was necessary, therefore, to vary the routine in order to fit the various men who were used, sometimes the writer doing the calipering as well as the tallying, and "sight" blazing. Other times the marker calipered and made both the "sight" and stump blazes. It was found that no set system worked equally well with all men.

The exact cost of the marking can not be ascertained because the writer kept his expenses in one account under "Forester's Expenses." As this account included the expenses of inspection and a certain amount of necessary surveying, along with the marking costs, accurate data can not be obtained for the marking alone. Assuming, however, that two-thirds of the "Forester's Expenses" can be charged to marking, the cost was $.781 per acre, or $.179 per 1,000 board feet cut. No charge was made for the Forester's time in the "Forester's Expenses" account.

2. *Falling the Timber:* In order not to injure the trees which were to be left standing, great care had to be taken with the falling of the marked trees. First of all an absolute understanding had to be reached with the falling crew that no trees were to be cut except those properly marked and stamped. This was done by insertion in the contract for the job of a specific paragraph touching this point. In this paragraph a cash penalty for each unmarked tree cut was stated. It was also arranged that if a tree which was being cut became lodged against an unmarked tree, the unmarked tree was not to be cut until the writer came personally and examined it and ordered it cut. As this portion of the contract was explicit, fully armed with teeth and entirely new to the woodsmen, it was difficult to get them to agree to it. Once work began, however, no trouble whatever developed in this direction. The severe character of the paragraph made the men take the work seriously and frequent inspection, coupled with praise for the good work

done, created a pride of workmanship on the men's part which resulted in a remarkably fine piece of work. Less than a dozen trees were seriously lodged throughout the entire operation and very little damage done to any of the trees left standing. When it is remembered that the trees were large, with wide-spreading crowns, this record is one to be proud of. The work brought out the highest degree of skill on the part of the men. The principal faller was a French Canadian whose ability in falling timber can fairly be said to be second to none.

Such careful falling required not only the use of axes and crosscut saws, but of iron wedges and sledges with which to throw the trees accurately.

The cost of falling, including trimming and bucking-up into logs, was $3.07 per 1,000 board feet. This included ties and lumber taken together.

3. *Drawing In, Sawing and Pitwork:* Following the timber fallers came the skidding teams whose work it was to collect the logs and haul them to the sawmill. This work was done—even when there was no snow on the ground—by teams of horses and wooden runnered sleds. Although apparently harder to draw over bare ground than wagons or two-wheels, in reality these sleds are better for this section of the country. Being light and low they are easy to shift about among stumps, rocks and brush and it is easier to put the logs on them than is the case with wheels or wagons. In addition, they are home-made and can be repaired on the spot. Although requiring comparatively short hauls and frequent rests for the horses, these sleds were able to carry from 400 to 750 board feet of logs at once. The wooden runners wore out rapidly, making it necessary to renew them about once a week in dry weather, but they were preferable to steel or iron runners because the latter cut in deeper and dragged harder over rocks or on dry soil.

Arriving at the sawmill, the logs were rolled off of the sleds onto the skids and then onto the carriage for sawing.

The sawmills used on this operation were standard portable mills of conventional type. Driven by steam generated in large steam boilers mounted on wheels, the fuel used was slab wood. This required care in the prevention of fires which might start from sparks but no such fires occurred owing to the use of spark arresters, watchfulness on the part of the crew and the precaution of burning all of the inflammable material for an ample area around the mill. Two mills were used at various stages of the operation, occupying altogether four set-ups in different parts of the property. These mills were capable of producing

as much as 14,000 board feet of lumber per day if driven hard with a full crew of men, but ordinarily averaged 6,000 to 8,000 board feet in a day.

As this was a hardwood operation and as most of the material cut was oak, a large part of the timber went into railroad ties, switch timbers, and heavy plank. The clear oak went into two and three inch plank, while the poorer grades went into ties, etc. The chestnut had been dead for a long time and was of poor quality. The bulk of it went into ties although some one inch boards and tapered fence posts of chestnut were also sawn. The whitewood (yellow poplar) that was cut went into inch boards.

Located so close to markets and with so much oak and chestnut in the material to be cut, it was possible to ship a great part of the material in a green condition, thus turning over the money invested rapidly and saving considerable work in piling and storing the sawn lumber. Whatever piling had to be done, however, was taken care of immediately adjoining each set-up of the mill. Edgings were used for "sticking up" the lumber and as it dried and was sold it was removed by horse-drawn wagons or motor trucks.

The cost of hauling from the woods to the mill, sawing and pitwork, including both ties and lumber, was at the rate of $21.14 per 1,000 board feet.

4. *Cordwood Cutting:* After the removal of the logs from the woods, the cordwood choppers cut the tops and branches of the large trees, which had been felled by the timber fallers, into cordwood. They also cut all the trees which had been marked for cutting but which were too small to use for lumber or railroad ties. As the material was almost wholly of oak and as the market for fuelwood was excellent, these cordwood choppers cut the wood as small as 2½ inches in diameter at the small end. Such close utilization practically eliminated all but the smallest brush and greatly improved the appearance of the forest and did so at a profit. The four piles of slabs and edgings at the four sawmill set-ups were also chopped into four foot lengths and piled, as there was a good demand for slabwood also. The cordwood cut out in the woods was piled wherever convenient, usually in piles containing one cord or less. Owing to concentration of material, the slabwood was usually piled in stacks containing more than a cord.

In due time, when the wood had seasoned, it was removed on horse-drawn wagons or motor trucks. In some instances a gasoline motor saw mounted on wheels was used to cut up the longer four foot sticks, into stove or fireplace lengths before delivery.

The average cost of chopping and piling both the slabs and the cordwood was $2.65 per cord. The cost of hauling and delivery varied so much that accurate figures on this item are not available.

Total Production

The following figures show the amount of material produced during the entire operation:

Lumber (including 13,356 board feet in tapered fence posts)	533,201 bd. ft.
Railroad ties (12,294 pieces)	409,667 bd. ft.
Cordwood	2,032 cords.
Slabwood	324 cords.

The Forest Left Standing

In order to give an idea of the forest itself, the trees cut and the trees left standing, the following results obtained from a very carefully taken sample plot are of interest:

Area of plot = ¼ acre. Upland Type. Quality 1 Site.

Trees per ¼ acre (Total)

	D. B. H.	Total Height
White Oak	8.9 inches	40 ft.
	14.6 inches	71 ft.
Black Oak	16.3 inches	73 ft.
	13.1 inches	72 ft.
	14.1 inches	64 ft.
	15.7 inches	81 ft.
	14.1 inches	84 ft.
	14.8 inches	75 ft.
	16.4 inches	84 ft.
	16.1 inches	67 ft.
Red Oak	15.0 inches	86 ft.
	7.0 inches	45 ft.
	7.7 inches	45 ft.
	12.3 inches	80 ft.
	14.1 inches	76 ft.
	20.4 inches	91 ft.
	20.2 inches	80 ft.
	19.1 inches	78 ft.
Beech	9.9 inches	56 ft.

Of the above stand six trees were cut as follows:

	D. B. H.	Total Height
Black Oak	16.1 inches	67 ft.
Red Oak	12.3 inches	80 ft.
	14.1 inches	76 ft.
	20.4 inches	91 ft.
	20.2 inches	80 ft.
	19.1 inches	78 ft.

From a very carefully prepared volume table worked out for this particular forest by the writer, the stand per acre on this plot was 13,040 board feet, of which 48.4 per cent was cut. The trees cut were all of the larger diameter classes.

This plot is typical of the whole tract and the figures give an excellent idea of how the forest was treated. In this connection it is important to realize that the best trees were left standing so that the cutting really improved the forest.

Rate of Growth

From the same sample plot above mentioned it was found that the average age of the trees cut was 87 years. Assuming the age of the trees cut corresponded to the age of the forest and also that it took three years on the average for the trees to grow up to the stump height, the total age of the stand would average 90 years. From the volumes shown above, the stand per acre equalled 13,040 board feet. Dividing by 90, the mean annual growth therefore equalled 144.9 board feet.

Danger from Windfall

In thinning out a stand as old as Saxton's Woods, the question of possible windfall comes up. What can be said against the claim that such an old stand will blow over if thinned so heavily?

Early in the summer of 1922 a hurricane blew over southern Westchester County, destroying many thousands of dollars worth of property and a number of lives. This storm passed right over Saxton's Woods when about one-half of the forest had been thinned. The results were of interest. In the unthinned portion of the forest there was considerable damage. Trees were uprooted, broken off and limbs and large parts of the crowns were torn away. In the thinned part of the forest, however, much less damage occurred. There the destruction was limited to trees on flat rocks where the soil was very shallow, to trees which stood on soft, wet soil which did not give firm hold to the roots, and to trees in very exposed situations. The reason for

this satisfactory result was that the thinning had removed the poor, weak, rotten and failing trees, leaving only the best, most healthy trees of the forest. The answer to the question as to the danger of thinning 90 year old oak stands is evident. The trees that should be left are apt to be windfirm.

Possibilities of the Future Forest

Scattered so evenly over the area, the trees left standing should thoroughly cover the soil with seed. If, thereafter, fires are kept out, there should be an excellent seedling reproduction under the stand. This would probably be of about the same composition as the present stand.

Opportunity of studying the possibility of increased growth on the part of the trees left standing was not found. The vigor of the trees, together with their excellent condition as regards space and exposure to light, suggests, however, that such an increase is to be expected.

Financial Returns

The whole operation resulted in the owners receiving a total of $6,486 for the stumpage cut. That is at the rate of $6.88 per 1,000 board feet cut. This contrasted very favorably with the original offer of the lumberman of $5,000 for all of the material 16 inches and over on the stump. In addition, of course, the owners had had their forest thinned and had retained one-half of the timber, and the best half at that. The increase in value from the real estate point of view of having had the forest cleaned up and given a park-like appearance must be counted as a return to the owners.

Altogether the Saxton's Woods operation was of value to the profession of forestry in America for a number of reasons:

1. It was an excellent demonstration of how American woodsmen can cut large timber under strict cutting regulations and do it at a profit to the owners.

2. Data were secured on volume, growth, and yield and upon the per cent of the stand removed which will be helpful to forest work in the Southern New England mixed hardwood region.

3. Excellent photographs of various stages in the work were secured.

4. The property became a center of interest in forestry for the surrounding section, resulting in similar operations elsewhere.

SOME NOTES ON THE PRESENT TIMBER SITUATION

By Fredrick S. Baker
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In 1920 the Forest Service presented to the United States Senate, a report commonly known as the Capper report, in response to Senate Resolution 311. This was the first of several publications dealing with the forest and lumber situation in the United States. Soon the Capper report was summarized in Department Circular 112, "Timber Depletion and the Answer," and in the same year "Wood For the Nation" appeared in the Department of Agriculture Yearbook. In 1922 the most thorough of the series, "Timber, Mine or Crop?" was published in the Yearbook, and lastly, U. S. Department of Agriculture Bulletin 1119, "Lumber Cut of the United States 1870-1920," deals with certain phases of the subject.

All these emphasized the seriousness of the national lumber situation and summarized one phase of it—supply as related to production—in the phrase "We are cutting our timber four times as fast as it grows." This statement made in varying words in all five of these publications, apparently struck a wide popular response, for it became a national slogan and apparently carried with it a very definite threat of impending disaster and timber famine.

The basis for such a statement has always seemed to me to be a little vague and I personally have never felt wholly convinced of its truth. Nevertheless, being convinced of the actual seriousness of the situation, I never saw any need of quarreling with the details of its presentation as long as the conclusions were substantially sound. Until recently the distrust of these figures and conclusions was more or less unreasoned, but having occasion to study them more carefully I found that they were in fact more illogical than I had thought and that as far as demonstrated in these publications, the phrase "We are cutting our timber four times as fast as it grows" becomes utterly meaningless when subjected to analysis.

Nevertheless, as intimated above, the statement, in spite of its illogical development and its lack of fundamental meaning, gives an impression that is not unwarranted by the facts of the national timber situation. Under such circumstances it may appear wisest to let it alone and not attempt to analyze it if such analysis is likely to prove it only technically indefensible. After careful study of the whole matter, I

can not subscribe to that point of view for I feel that it places all foresters in an unnecessarily weak position, in that the statement—and all that goes with it—will not bear close inspection, and that being fundamentally weak does not allow the erection of further lines of argument upon it. Instead of a real edifice, a house of cards has been erected, and the worst of it is that it was entirely unnecessary. Nobody has pushed down the house of cards; it has been convincing, but consciously or unconsciously we are all handicapped by the fact that in the center of our arguments about the timber situation, there lies a big fundamental weakness.

But to get down to brass tacks. The whole difficulty lies in the concept of "growth" used throughout these publications, which in turn seems to have come from the apparently harmless idea that in virgin timber growth balances decay and that therefore in comparing depletion with growth the virgin stands can properly be left out of consideration.

I might explain drily and at length why this idea is unsound when used in the development of such arguments as are presented in the reports and articles already mentioned, but it is much more interesting to note some of the absurdities this philosophy leads to.

Take for example a specific working circle I have in mind, an area of virgin timber where growth is now balanced by decay, and so "growth" in the sense used in these publications is nil. An annual cut of 12 million feet on a sustained annual yield basis is possible under a 30 year cutting cycle. Last winter the first cut was made. What a horrible situation is now presented! Only one-thirtieth of the area is "growing." The "growth" this year is only one-thirtieth of the 12 million feet cut—the "depletion" on the area. If the nation is bad off with depletion four times the growth, what shall we say of this area where the depletion is thirty times the growth. Yet we are securing a sustained annual yield. This example alone should be evidence enough that something is wrong with the reasoning presented.

If instead of applying this philosophy to a single small area, an area like a single National Forest is taken, again strange conclusions must be reached. The forest with large areas of virgin timber is contributing mighty little "growth" to balance the "depletion" of the nation. The "lodgepole forests" so-called are doing much better for they have fortunately been largely burned over and have stands of immature "growing" timber. The heavily cut-over forests are likewise producing relatively well. The Minidoka National Forest contains 86 million feet

of timber, the Kaibab about 1,700 million, yet, because in the first case the stands are largely immature lodgepole pine, or have been cut over, the "growth" is practically equal to that on the Kaibab Forest where mature yellow pine predominates. It is certainly not true that both have the same significance. In recent years bark beetles have been raising Ned in the Kaibab timber, destroying millions of feet of fine mature trees. The Forest Service is fighting the beetles, spending good money, yet these bugs apparently ought to be considered as really beneficient, for they are rapidly putting the Kaibab in the "growing area" class.

Even when larger areas are considered, the fundamental fallacy expresses itself in absurdities, one of which has been sufficiently obvious as to draw a word of explanation in both the "Capper Report" and "Timber-Mine or Crop?" In both these publications the ratio of growth to depletion is noted in the six main timber producing regions. Taking all products on a cubic foot basis, depletion is greatest in comparison with growth in the Lake States, although the Pacific Coast states come close second, while New England is not at all bad off. The Pacific Coast and Lake States are about on a par, simply because devastated lands and virgin timber are exactly equivalent. The explanation states that on the Pacific Coast growth is low because of the large areas of virgin timber in which growth is balanced by decay and that as cutting proceeds the growth should increase. As far as the present situation is concerned, however, the virgin timberland is shown as no more of an asset than brush-covered hills.

In the Intermountain District our figures show growth and depletion almost exactly balance, yet the total cut on private and National Forest lands is only about one-fifth of the present possible sustained annual yield.

An analysis of the "1950" situation outlined in "Timber-Mine or Crop?" further reveals how untenable the conception of "growing areas" proves. This situation is described as follows:

> "What increased timber production can be expected by 1950 if this crude kind of forestry is immediately put into effect? First, large portions of the present denuded land will seed naturally to forest growth within 30 years. Second, most of the remaining areas of virgin timber will be converted, as they are cut, into young growing stands, and the total growing area can be increased 100 million acres. Many of these areas, however, will have only incomplete growth upon them by 1950. Third, many of the present

second-growth forests would produce wood faster than they are doing now with their vigor and density reduced by periodic fires. On the other hand, considerable areas of rapidly growing second-growth will have been cut, thus tending to reduce the average growth rate.

"The net result of the application of a system of crude forestry, consisting chiefly of protection from fire, may thus be put as an approximate increase of 4 billion cubic feet in the current production of wood, or a total annual growth by 1950 of 10 billion cubic feet on 353 million acres, 100 million from cut-over areas."

Your attention is directed especially to the "secondly" above. We now grow 6 billion cubic feet on 326 million acres of cut-over land (including devastated). In 1950 with the same destructive logging continuing we will have 100 million acres more cut over—some destructively, some not, about as we have done in the past. The total of 426 million acres without even crude forestry ought to produce 7.8 billion feet. "Timber-Mine or Crop" estimates the growth in 1950 at 10 billion cubic feet, so that in reality only some 2.2 billion increase will be due to "crude forestry" instead of the 4 billion as appears on the surface.

The detailed figures upon which the picture of the 1950 situation was built, are not available to me except in the case of the Intermountain District of the Forest Service. Here we have an area well forested in proportion to the demands upon it, large virgin areas, few fires and few old burns not restocking. Practically the entire forested region is within National Forests. The progress of cutting by 1950 will not result in great inroads upon our virgin stands. Consequently although a very good brand of "crude forestry" will be practiced and protection will be decidedly effective, the "growth" in 1950 will still be quite low, because of the inability to transfer much of our virgin timberland to the "growing area" column. In truth, if this area is to "produce" its best by 1950 and add more than an infinitesimal drop to the national bucket, we must train up an efficient corps of incendiaries. Doubtless they will make some of our lands permanently non-producing, but from past experience, most of the burns will reproduce. Perhaps on second thought, careful propagation of bark beetles might prove better, certainly they are doing wonders on the Kaibab, which by 1950 ought to be showing excellent "growth" at the present rate of destruction.

To sum it all up, then, the ratio of growth to depletion has no meaning whatsoever. Nationally considered, it is not obviously absurd because so large a part of our timber has been cut over and the fallacy becomes less and less obvious as virgin stands dwindle, till at last when all are gone, it vanishes. In a virgin country the fallacy would be patent. Imagine a Pilgrim forester raving because his brethren were cutting down the timber a *million* times faster than it grew—which would be a truthful statement if we grant America's forests were virtually virgin stands at that time, with growth balancing decay and no net increment.

In truth it matters nothing whether depletion is four or forty times growth if sufficient virgin timber is left, for every time cutting takes place a new additional area is made "producing." If enough of these producing areas can be added to our present cut-over and producing land to bring the "growth" ultimately up to "depletion" well and good—we are sitting pretty. Even crude forestry would be a luxury in a case like this. The crux of the whole situation then is whether the future growth on present virgin timberlands after they are cut over, added to the present growth on cut-over lands can equal "depletion" or use by the nation. The total potential growth is the figure with real significance and is one that can be used logically in virgin stands, timber sale areas, single National Forests or anywhere without introducing obvious absurdities. A clear-cut presentation of this fundamental fact is nowhere given in any of the publications cited, although a half developed picture often appears. Nor is the question as to whether this potential growth can ever balance depletion answered except by inference. The answer, of course, is no, that the potential productivity of the present virgin stands can not add the necessary "growth" to meet depletion, using present day methods. How big a gap is left may be figured roughly from several starting points. Most simple is this. We have cut over or burned two-thirds of our original timberland, i. e., this is our producing area. It gives us 6 billion cubic feet a year. The remaining third would appear to promise 3 billion feet without any more forestry than we have had in the past or an ultimate total of 9 billion feet annually. This is about one-third of the national need for timber (25 billion cubic feet).

"We are using timber three times as fast as we can ever hope to produce it under present methods." There is a statement with teeth in it, because it is strictly true.

Other calculations using more definite figures, taking into consideration the high potential productivity of Pacific Coast timberlands—partly offset by low productivity in the central mountain region—the effect of forestry on the National Forests, and so on, give a more accurate and somewhat higher figure for possible future growth.

What "crude forestry" really means is clearly shown in "Timber-Mine or Crop?," not in the 1950 figures but in the statement that ultimately it would mean a production of 14 billion cubic feet a year, a figure still far below the needs of the nation. This figure is logically derived as it takes in all timberlands as the "producing area."

Likewise the growth of 27 billion feet a year under intensive forestry is as sound as the data from which it was derived.

I have so far ignored the question of the reserves of timber tied up in virgin stands. In the last analysis they have little significance, for sooner or later they will be gone and the nation will find itself dependent upon what it can grow. These reserves do indicate, however, *how soon* the day will come. Any analysis of this which would tend to indicate the years our virgin timber would hold out would be foolish on my part. It is very intricate and requires a large amount of data as many factors are involved. Rough computations indicate that the period is alarmingly short, however, and that crude forestry is not as much a remedy as would appear. Our present production is 6 billion cubic feet a year. Without forestry, it can apparently never exceed 9 billion cubic feet. Since our national consumption is approximately 25 billion cubic feet a year, it is obvious that some 18 billion cubic feet must be drawn from virgin stands. The volume of virgin timber in cubic feet has been published nowhere as far as I can learn. Apparently, however, it is not far from 500 billion cubic feet. If this is depleted at the rate of 18 billion cubic feet annually, it is obvious that it will last only something like 28 years, after which time the lumber industry of America will have to accommodate itself to the meager annual growth of 9 billion cubic feet.

As already pointed out, the big increase shown in "Timber-Mine or Crop?" between the present time and 1950 is due largely to the increased growing area and only 2.2 billion out of the total increase of 4 billion is directly chargeable to forest protection. Taking the whole period of 25 years between now and 1950, we can hardly count on more than an average of a billion cubic feet per year of true additional growth, not derived from increased area. This means that we will have to draw on virgin stands at the rate of about 17 billion cubic feet a year instead

of 18 billion cubic feet. This serves to draw out the period of 28 years to about 30, which is practically no improvement at all. We must have real forestry and have it quick.

To summarize, I believe that a careful study of the figures shown in the series of five government publications referred to, indicates that the growth figures at the present time as related to depletion of the timber have no real meaning but that if correctly interpreted they do show that without forestry the nation can never succeed in producing over one-third of its timber needs. Furthermore, this analysis of the figures shows that if forestry is to bring growth up to such a point that it will practically satisfy the needs of the nation, it has got to go to work immediately and work hard, as the period allowed for this accomplishment is alarmingly short. Furthermore, crude forestry consisting of forest protection mainly, will actually do very little to improve the situation and that a more intensive brand of forestry is an immediate necessity.

PRESENT PROBLEMS IN FOREST EDUCATION*

By Hugo Winkenwerder
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What I have to present in this paper is in a way a report from the chairman of the Educational Committee. I have to apologize for not getting the various sub-committees under way in time to present some definite conclusions at this annual session of the Society. When I accepted the chairmanship of the general committee I did not realize the many problems with which I was to be confronted during the past year, some of which I fully expected to be out of the way by last spring and others which I could not foresee at all, but it has just been one blank thing after another. Had I known what I had before me I should not have accepted the chairmanship of this committee. However, between carrying two lecture courses; building, moving into, and dedicating a new home for the College of Forestry; carrying practically the whole burden of American Forest Week for the State of Washington (which represented fully two months of intensive work instead of one week); directing the work of six standing committees of the Washington State Forestry Conference; and finally, having a special session of the State Legislature sprung on me beginning October 9th, it was practically impossible to do much with the Educational Committee. However, I endeavored at least to get the work of the Educational Committee underway and, with President Dana's assistance and patience, instructions for the committees have been prepared, committees appointed and the work launched. This was, however, not gotten underway until a few weeks ago and there has hardly been time for any of the committees to work out their specific problems. I hope, therefore, that what I have to present, which is largely based on the suggestions made to the chairmen of the various sub-committees, may provoke some discussion by these latter as well as the other members of this gathering. Such discussion will be helpful in solving the various problems and I am sure will be appreciated by the members of the committee.

The problems before us may be stated in a general way by reference to the names of the sub-committees, these include graduate work in forestry; non-professional courses and extension work; forest research in educational institutions; the training of specialists in forest

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products; vocational training in forestry; public service in forestry; undergraduate courses; specialization in forestry training; and the committee on the standardization of forestry literature.

In planning for the work of the future Mr. Dana and I agreed that the work of the sub-committees on Undergraduate Courses in Forestry and Specialization in Forestry Training seem to have been pretty thoroughly covered and can be dismissed at least for the present, and that the sub-committee on Standardization in the Classification of Forestry Literature should be revived as a full standing committee rather than a sub-committee of the committee on Education. Although Mr. Dana and I have conferred rather freely in arranging for the new work of the committee I am assuming full responsibility for the statements presented in this paper.

During the past by far the greatest emphasis has been placed on the undergraduate courses in forestry and the recommendations made in this connection have been wonderfully helpful in the development of these courses. The work of this committee was concentrated very largely on two points; first, the comparative advantages of the four and five year courses, and second, the standardization of the curricula.

There seems to be rather a general agreement among all the men of the profession that we should strive for the five year course but there has been some disagreement between the Eastern and Western schools concerning the adoption of the longer courses at this time. The majority of the Western schools seem fully convinced that they will not be able to hold more than a very few of their students for more than four years. No one will deny the general success of the four year course. Practically all of the forest schools point with pride to the large number of four year students that are making eminently good. Then too, comparison of the undergraduate courses in forestry with those of other professions will show that although the forestry courses allow very little leeway for election they nevertheless offer a far broader training than many of the others, notably engineering. In spite of this there are those of us who, having had the advantage of pursuing some of the broader cultural subjects, feel that the lack of these in the undergraduate curricula is robbing the student of the opportunity to learn to appreciate and enjoy some of the very finest things that a college education can give. However, we must recognize that the spirit of the times makes almost every young man look forward to early financial independence and business success, and he is restless to get into the work of the world. This, together with the high cost of education, a more

or less general spirit of indifference toward real culture, and the desire and need for specialization prevents the great majority of students from looking with favor on more than four years of college training. Ample provision is made at practically all of the forest schools for a broad training based on a five year course. An increase in the number of students who will take advantage of this will depend largely on moral suasion, a most difficult matter for the forest school faculties when there is such a lack of it in the homes and the high schools. In making these statements I do not want to infer that the forestry students are not of the best; enthusiastic for their profession, intelligent and diligent workers, it is merely the spirit of the times.

There are those in the profession who believe that the substitution of more fundamental work and more of the broad cultural subjects for some of the practical and specialized courses will produce men of greater ultimate capacity. Here again there seems to be rather general agreement that it will, yet the whole history of education has been a gradual development from the general to the specific. Has it been overdone? If so the question is to find the happy medium.

On the question of standardization of curricula I feel that we have reached the point where there is a rather general understanding as to the content and the amount of time to be devoted to each subject. We now have a fair selection of good text books and others will be forthcoming. These will in large measure determine the general content of the courses. This must, of course, be modified, extended and illustrated with regard to regional requirements. Any further work done along the lines of undergraduate courses should be devoted to principles rather than details.

The great difficulty in connection with the content of the courses during the next few years is going to be to keep them fully abreast of the times. This is well illustrated by the advances in the methods of forest mensuration made during the past few years, by Bruce and others, which are now being adopted by the Forest Service but which evidently are not being adopted very rapidly by the schools. A similar problem will be presented as a result of the extension of research in silviculture now being organized.

The name of the committee on the course leading to the degree of Master of Forestry has been changed to the committee on graduate work, as more fitting because many of the state institutions offer the degree of Master of Science in Forestry and it is after all the graduate work rather than the degree in which we are interested. The work

which has been done by this committee in the past was devoted largely to a discussion of the advantages of the five year course and in that respect supplemented the work of the committee on undergraduate courses.

So far as I have been able to learn there has never been any extensive study undertaken concerning the standardization of graduate work. This work is at the present so variable in character that the Educational Committee can well afford to concentrate for the present on this phase of the subject. A perusal of the courses offered shows a tremendous variation at the different institutions. There is, for example, a very broad variation in the standard of work required of the graduate student. Previous training and ability of the faculty and the equipment available, both as to apparatus and the necessary field conditions, also have an important bearing on the quality of the work.

A thorough study of this problem as it presents itself at the different forest schools will undoubtedly reveal some interesting conditions that may indicate a need for raising the general standard of graduate work. It is also true that certain of the schools present conditions which make them particularly attractive for students who desire to specialize along certain lines. This is even more important in graduate work than in the undergrad courses.

The following has been suggested as an outline for the study of this subject.

A. Minimum Standards for Graduate Work

I. Preliminary undergraduate training required.
   a. How do these requirements of the Forest Schools compare with the requirements for admission to graduate standing in other professional schools?

II. The standard of work required of the graduate student.
   a. Compared to the standard required for the undergraduates. Should, for example, a student with a Bachelor's degree but no training in forestry subjects be allowed a graduate degree by completing practically the same courses taken by the undergraduates.
   b. Should there be a certain proportion of distinctly advanced work presupposing an undergraduate training required for the advanced degree? If so, what should that proportion be?

c. Should exceptions be made to "a" and "b" above for students who show unusual qualifications and who may be granted the advanced degree on presentation of satisfactory evidence that they have accomplished work worthy of the advanced degree? What should be the measure of such accomplishment?

d. Should the graduate degree comprise the ability to do original investigative work?

III. Previous training, ability, and condition-of-work of the faculty. (Note: This is a ticklish subject and must be handled with great tact. Nevertheless I believe that an investigation into these points will bring out some interesting facts and may be useful, as well as in other ways, to help those schools working under a disadvantage to get better support for ironing out the weaknesses.)

a. Training and experience.
   (1) Education
   (2) Experience.
   (3) Accomplishments.

b. Amount of time required for straight teaching.

c. Amount of time required for administrative and other general duties.

IV. Amount of time and opportunities available for

a. Research.

b. Contacts with practical work.

V. Equipment.

a. What special facilities has the school for doing advanced work along specific lines (specialization)?
   (1) Laboratory apparatus.
   (2) Field equipment.
   (3) Regional opportunities.

VI. What outstanding opportunities have any of the schools that would make them particularly attractive for special advanced work in certain fields?

Non-professional courses and extension work offer unusual opportunities for the forest schools to be of general service as well as for propaganda in the whole field of forestry. The field is covered by the outline:

Types of Extension Work being done: how it is being handled and what results are being obtained.

A. *Special Courses*
   (1) Correspondence courses.
   (2) Courses open for credit to students majoring in arts and sciences, etc.
   (3) Special courses offered as service courses to other departments. (For example, Washington has offered a special course in wood technology required for graduation, of certain majors in architecture and two special elective courses for students in business administration.)
   (4) Reading courses.
   (5) Extension lecture courses.
      a. General public lecture courses.
      b. Courses offered for credit.
      c. Special courses for industrial employees, etc., e. g., kiln drying, etc. (May overlap with vocational training.)

B. *Public Education Through Exhibits*—county fairs, merchants' expositions, sportsmen's shows, etc.

C. *Supplying educational material for public gatherings.*
   (1) Lantern slide collections with lecture outlines for loans to schools, churches, women's clubs, etc.
   (2) Other loan or gift material.

D. *Permanent projects.*

E. *Farm bureau and county agricultural agents.*

F. *Checking over public school and university texts*—particularly the former—such as common school physical and commercial geographies, wood working manuals, general texts in agriculture, etc., to see whether they are up to date.

The committee on Research in Forestry in Educational Institutions. Professor R. T. Fisher, chairman of this sub-committee, feels that there is no obviously useful function which the committee can serve at this time. "Through the agency of the Rockefeller Foundation," says Professor Fisher, "the American Academy of Sciences has appointed a committee to make a thorough survey of forest research throughout the country and in which work of colleges and Forest Schools will be properly included. Already the Northeastern Forest Experiment Station has prepared and published its first periodic summary and digest of research in progress, and projects of all agencies in the region. A similar service will undoubtedly be performed by the experiment stations in other regions."

Professor Fisher recommends that the committee on Research in Forest Schools be either discharged or postpone its activities. I can not help but feel, however, that this committee can perform a very useful function at this time. It is true that the research work in forestry the country over is just getting under way on a really extensive and well organized basis, and of course the forest schools will be given an opportunity to cooperate in this work. It may be true, as Professor Fisher suggests, that the problem of how the Forest Schools can assist can be worked out to better advantage after the reports of the Rockefeller Foundation and the various forest experiment stations have been completed. I believe, however, that the Society can, through its Educational Committee, do an interesting and valuable piece of work through a survey of the research work done and being projected at the Forest Schools, together with any special equipment they may have, the system they have in force for carrying out the research work, and the financial support they receive for this work. I sincerely hope this committee will conduct such a survey. Some of the schools are doing considerable. I am sure the rest would be glad to know what they are doing and how they are doing it.

The former committee on Vocational Training in Forestry, under Professor Zeigler, prepared a very valuable report submitted at the last Yale Conference. In the past, during the period when there was an emergency in the matter of finding men for the minor positions there was a very great need for vocational training for forest rangers and guards. The development of the work of the forest ranger has, however, been such that he is now in need of a far larger amount of technical training than can be offered through the short vocational courses formerly offered by several of the Western schools. The condition has furthermore been changed as a result of the policy adopted by the Forest Service last year to apprentice all technical men who are looking forward to administrative positions to the ranger position during an indefinite period, promotion depending upon ability and openings. This further reduces the need for special short courses of this kind. What is the present and possible future of this work?

The question now also arises as to whether there is not a growing need for a type of vocational training for the men in the various industries. The Forest Products Laboratory, and the New York State College, for example, have conducted courses of this kind in kiln drying. Similar courses, for men engaged in the practical work in many of the industries allied to forestry, should offer an unusual field for

useful work. It is being done in many of the other large industries. What is this field in forestry education and how can it be developed?

The sub-committee on the Field of Public Service in Forestry by Educational Institutions. The work of this committee is to be limited to technical and other similar service to the public rather than that of training students for public service. Some of the forest schools are devoting nearly as much time to general service of the former type as they are to the training of students. The forest schools should be leaders in their respective localities in matters pertaining to forest development and are in a position to offer technical advice, and service to public bodies, industries and the public generally. The committee has been asked to make a study of just what the various forest schools are doing along this line, and that it distinguish between work done purely as service, that is without pay, and that for which a charge is made. In this connection it might also be well for the committee to give thorough consideration to the question of consulting work done by the forestry faculties, and its relation to the regular consulting foresters in such matters as possible trespass on the legitimate fields of the latter, comparative fees, etc.

The sub-committee on Specialization in Forestry Training has been disbanded on the suggestion of its chairman. One of the great mistakes made by some of the forest schools has been the tendency to want to offer opportunities for specialization in practically every new field developed. Much better work could be done in all of the schools if we would recognize that each has some very exceptional advantages for doing high grade work along certain lines. A concentration on these specialties without a dissipation of our energies over the entire field would be a great step in advance in the whole system of forest education.

Concerning the work of the committee on the Training of Specialists in Forest Products, two rather comprehensive reports have already been prepared. In the last report which was made, rather specific curricula were developed for several courses. Although I was a member of the committee which prepared this report, subsequent study of the subject makes me feel that work outlining general principles will be far more useful than the development of detailed curricula because the conditions at the different universities make it practically impossible to even approach the adoption of the suggested details. I believe that the whole principle of specialization, especially in fields where the demand is small, can be handled fairly well on the basis of the individual requirements

of each student. I may be criticised for this statement in that it would appear to approach the vocational training idea. The work can, however, be held on a really broad basis by allowing the students to make substitutions for some of the courses we would ordinarily require for the general forestry course, and that such an arrangement is the only one which will solve the question of preparing young men for special fields in which the demand is limited. This I think will also be true for the chemist in forest products, as well as the forest pathologist, entomologist, etc. A distinction should probably be made on the basis of how much the individual expects to be chemist, entomologist, or pathologist, on the one hand and on the other forester, using the term forester here in its broadest possible sense. Many educators feel that it is impossible to give a student a complete training in both forestry and one of the pure sciences, in a four or five year course. That is undoubtedly true. Much, in fact most of the work in which a combined training is important does not require a complete training in both.

It is not a difficult matter to adjust our present curricula to meet the needs of these specialists without the necessity of trying to establish hard and fast courses for each one of them. Nor do I believe that two or more men going into the same field of work along any special line would need exactly the same training. In any study of this question it might be well to examine the training of those men now successfully engaged in these specialties as a basis for arranging the university courses. The criticism has, for example, often been made that students trained in logging engineering or some special phase of the work in forest products could be properly trained in less than five or six years' time, yet the large number of men trained for these positions in four years who are making eminently good is an indication of the success of these courses.

In conclusion your chairman of the Educational Committee will be glad to receive suggestions pertaining to any of the work which has been outlined for the various subcommittees.

THE FUTURE DISPOSITION OF OUR REMAINING PUBLIC LANDS

By Herman H. Chapman
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Two questions have stood out conspicuously since the very origin of the policies for dealing with the public lands acquired by the National Government; first whether and to what extent these lands should be held as national property or disposed of to private owners; second, to what extent and for what purposes these lands should be granted to the states, to be held or disposed of by these state governments.

Both of these questions became acute nearly a century ago or about 1830. Congress at that time, under the leadership of Henry Clay and Daniel Webster decided that as a whole, the public lands should not be granted to the states but held and disposed of directly for the good of the whole nation. This policy has never been set aside despite numerous attempts to undermine it. On the second question, the early decision was adverse to the retention of ownership or landlordism and thus was created under the U. S. Land Office the traditional policy of disposing of public lands, which has dominated this department down to the present year.

Successful when applied to agricultural lands, this policy of private acquisition broke down completely when dealing with timber lands. Under private ownership the well nigh universal tendency has been to destroy this resource without a thought for the future or for the public welfare. The economic problem thus created has not even yet reached its most acute stage but bids fair to be the most serious in its consequences of any that this nation has ever had to face. Canada never made this error but retained public control of her vastly greater percentage of forest lands from the start. After a full century of demonstrated misuse and devastation, this policy was squarely challenged and gradually reversed, beginning in 1891, by the process of withdrawing public lands bearing forests from further private acquisition. This initiated the era of the so-called conservation policies, which meant the adoption of the second of the two principles; not only should the nation retain merely disposition but the ownership of these resources as well.

Under these two policies the National Forests were built up by presidential proclamation for the purpose of conserving the timber and protecting the watersheds.

It at once became apparent that timber and water were not the only resources within these great areas and even before the National Forests were transferred to the Department of Agriculture in 1905, a start had been made in recognizing mining and grazing as necessary uses of the land. The filing of mining claims was authorized in 1897 on any National Forest land and this policy is still pursued. Grazing was permitted where it could be shown that no damage would be done to the forest. In 1906, the Forest Homestead Law was passed and through this means and by eliminations and finally in 1912 by the classification of all lands within the reserves, the agricultural lands were opened to settlers.

Meanwhile a policy of regulated use of the lands for grazing was built up within the National Forests whose purposes were to get maximum utilization of forage without destroying the range; to exercise rigid control so as to prevent damage to the forest or watersheds; to prevent the establishment of perpetual property rights to grazing by existing users; to prevent monopoly of the range by a few users; and to distribute grazing privileges to settlers and homesteaders or small owners basing preferences on residence and priority of use. Through the experience of two decades, an excellent and efficient system of administering these permits was worked out satisfactory in the main to all stockmen except those who desired favors to which they were not entitled in equity to others.

Fully occupied with the tremendous task of protecting these forests from fire, building trails, roads and cabins, and organizing timber sales and forest management, the Forest Service had scant time to consider recreational uses until recently. The National Parks remained where they originally had been, within the Department of Interior, under more or less desultory management until very recently when the National Park Service was organized in that Department and the care and management of these parks was thus crystallized as part of the functions of the Interior Department as are the Indian Reservations.

Thus in considering the future disposition of the remaining public lands we face the following conditions which are the result of historical development of these policies, namely, that the public domain is now divided into two great bodies, reserved and unreserved; that of the reserved lands nearly 95 per cent is administered by the U. S. Department of Agriculture as National Forests for the purposes of co-ordinated development and use of all the resources they contain except minerals, and that on the remaining area, or National Parks, the policy

desired by the public but not fully carried out as yet is the prohibition of all such commercial development and use, and the devotion of these areas exclusively to park and recreational purposes.

This condition has been created by congressional enactment on the theory, presumably, that best results would be attained by this division of functions. It was held, after an initial period of years, 1891-1905, that the Department of Interior was not equipped to handle problems dealing with the productive use of land for crops, either of wood or of livestock. Was this conclusion justified? The public has now had twenty years more in which to judge the results, which are given below:

1. Much timber remained on public unreserved lands whose further reservation was prevented in 1908 by act of Congress. This timber needed fire protection and management as much as that within the National Forests—but the Interior Department was not interested.

2. The need for public regulation of grazing on the vast unreserved public domain became annually more pressing. The Forest Service was successfully demonstrating how the problem should be solved on areas adjoining these lands, but the Interior Department made no move. Instead it emphatically declared that it did not intend to adopt any such policy but, instead, would seek new laws whereby title to additional lands could be acquired by private owners and proceeded to secure the passage of the stock homestead law giving 640 acres to any individual who would establish a home based on the use of this land for grazing. It went further, and in 1910 made such a vigorous protest against the extension of National Forest reservations to cover lands primarily of value for forage that it forced the relinquishment or elimination of over 20,000,000 acres of such lands on which public control and conservation of the range had been already established and thus threw this land wide open to unregulated competition and consequent range destruction in spite of the vigorous protests of the stockmen themselves who desired the continuation of protection.

Within the last year the Secretary of Interior has suddenly awakened to the fact that the business of land disposal is about at an end; that if he confines his interest in the public lands to disposing of them that this part of his organization will soon automatically dwindle to small dimensions for the simple reason that, huge as the paper areas of public lands appear, few persons are willing to file on them either for agriculture, mining, stock homesteads or timber because the values remaining on these lands are too low to justify the effort. The lands

are left on the hands of the government and it can't get rid of them under any existing laws.

In seeking a way out, the Secretary made the discovery that conservation and use of the resources of these lands, chiefly the almost ruined resource of grazing which had been so completely neglected by his department, offered a way out, and in his last annual report for 1925, the merits of conservation are set forth as an original discovery ignoring utterly the work of the last 35 years, both originally in his own department and afterwards as transferred to and carried on by the Department of Agriculture.

Meanwhile, the newly created National Park Service, in seeking extensive enlargements of existing national parks in California and elsewhere, found that the lands desired for these purposes were already set aside as National Forests and devoted to different purposes, namely the development, conservation and *use* of timber, watersheds, grazing, minerals and agriculture through irrigation. From this situation rose a conflict of public interests as represented by the opposing policies of use or non-use of these resources which was inevitable if lands now devoted to a well developed and complete policy of use were to be transferred and changed in status and these uses cut off. In their effort to increase the area of these parks, the Park Service, finding themselves pocketed and surrounded by National Forests, not only compromised the policies of park conservation by advocating and permitting grazing and other mistakenly legalized commercial uses within certain parks but launched repeated attacks on the Forest Service of the Department of Agriculture in an effort to weaken its prestige and thus make it easier to secure these transfers of land from Forest to Park, and from one department to the other. This spirit of attack culminated only last year in a notorious article by one Gregg, a private citizen, which appeared in the Outlook Magazine.

Along with this attack, the hue and cry was raised of inter-bureau jealousy and the public impression was widely created that the trouble was merely a petty quarrel between two departments each of which was envious of the other's prestige and was doing its best to build itself up regardless of public welfare.

This smoke cloud has largely obscured the fundamental issues of public policy involved. Unless the public is able to recognize these underlying questions of policy and to judge as to the best means of securing the public ends desired, they will be easily led off the trail of these issues by just such a red herring as this clamor about inter-

departmental jealousy. Fortunately the park situation is now reaching a satisfactory adjustment as to boundaries and policy and has ceased to be an outstanding issue.

But this leaves open the far greater question of the permanent policy for the remaining unreserved public lands. Grazing is the largest use to which these lands can be put and this grazing must largely continue as a public use for the reason, as stated, that the lands are too poor to bear private ownership under existing laws. The urgent conservation question of the day, therefore, is public regulation of these lands, chiefly for grazing. *This question is inseparable from that as to what department is best fitted for such a trust and should undertake this responsibility.*

The respective departments, those of the Interior and Agriculture, should have little if anything to do with settling this question. It is primarily one for public opinion, acting through Congress, to decide, in an effort to secure the best good for the nation. It should no more be a question of inter-departmental prestige than was the transfer of the National Forests to the Department of Agriculture by legislative enactment in 1905. But its right solution will have far-reaching effects not only on the public domain but on the National Forests as well.

If the remaining public lands are to be reserved for the properly regulated use of their resources, the control of such use should be placed with the Department of Agriculture for the following reasons:

1. The disposition of lands under the agricultural homestead and mining laws will not be interfered with in any way. Thus the Interior Department will continue its normal functions of passing on titles and claims which it is now exercising on these same lands, without any change whatever. Therefore this change takes no functions away from this department which it now possesses.

2. If the grazing resource is to be conserved, the stock homestead law should be repealed, as it has demonstrated its economic failure.

3. The remaining timber resources on these lands will be better administered by the Forest Service than by duplicating fire protection, timber sales, forest planting and other activities in another department for a residuum of timber lands not now in the National Forests.

4. Watershed protection, a primary use of the National Forests, will receive full consideration as against grazing if placed in the Department now responsible for this objective.

5. The grazing resources will be administered by a department which has had twenty years of training in this line and has demonstrated its efficiency in handling grazing problems.

6. The administration of grazing on the entire public domain by the same agency is manifestly in the interests of efficiency and unity of policy and administration.

If on the other hand the Department of Interior at this late date succeeds in securing a law authorizing it to inaugurate a grazing policy on the public domain, the following disadvantages arise:

1. This department is without any knowledge or experience as to grazing, which is a field problem requiring a definite technique. Such administration is therefore bound to be inefficient at the start.

2. Due to this initial lack of experience and inefficiency and possibly coupled with attempts to utilize existing machinery in the department (see the Stanfield proposal to designate the Registers of Land Offices as supervisors of grazing), the tendency will be for the stockmen to get the upper hand and secure what amounts to perpetual and exclusive grazing rights on this public domain, to the exclusion of new comers and small owners or settlers. (See protest of National Grange against regulation of grazing on public domain.)

3. The administrative regulations and the basis of grazing fees are almost certain to differ from those in force on the adjoining National Forests, thus setting up a tension between these areas and departments.

4. The worst danger is in creating two sets of reservations lying in different departments in one of which grazing is dominant, while in the other it is not. This will inevitably lead to a land classification problem similar to that which has caused so much irritation regarding the National Parks, but on a much larger scale, in which the classification again involves transfer of jurisdiction from one department to another and consequently will throw on to the lists the entire force of each department and the policies for which each stands. The conflict which such a situation would precipitate would dwarf any past occurrence and is absolutely inevitable, since the Forest Service is bound by its responsibility to the public to endeavor to protect watershed interests against possible grazing damage. At least 40,000,000 acres of land now within the National Forests would be involved including such key areas as the Tonto Basin protecting the Salt River Watershed and the Roosevelt Dam; the Angeles National Forest, covering the water supply of the orange belt about Los Angeles; and other similar areas elsewhere.

The failure of the public to recognize this question as affecting public policy in a big way has resulted in its being treated as merely an inter-bureau question. The efforts of the Forest Service, which

did *not* have jurisdiction, to get this resource cared for have so far been easily and completely nullified by the persistent refusal of the Interior Department to even consider the matter, which thus remained at a deadlock for twenty years. The Department of Agriculture is equally powerless at the present time to even suggest what they may consider to be the best public policy since it would be the apparent beneficiary of this policy.

The Interior Department having now decided that it is to its interest to undertake the regulation of grazing on the public domain bids fair to fall heir to this responsibility through sheer inertia and the desire of the present administration to avoid any semblance of departmental quarrels. The public welfare may not even be considered in the matter. The Forest Service after repeated previous failures covering two decades, seeing the hopelessness of securing the obviously rational solution of creating jurisdiction over this grazing within the Department of Agriculture, are apparently willing to let the Interior Department have the grazing rather than to be forced to stand by any longer and witness the progressive ruin of the range without power to lift a hand to stop it.

But if any lesson is to be drawn from this situation it is the need for public opinion to demand a rational solution of the policy of future use of our public domain regardless of departmental precedent or desires. This question will not be settled by merely taking the lines of least resistance, saddling the Interior Department with new and unfamiliar duties and at the same time creating duplicating bureaus of grazing in two departments on adjoining public areas. Grazing administration will be put on a sound basis only when it is placed in the Department of Agriculture where all existing similar work has been developed and is now carried on.

MODIFICATIONS IN FORESTS OF THE PACIFIC SLOPE DUE TO HUMAN AGENCIES*

By S. B. Show
Silviculturist—U. S. Forest Service

The importance of the forest as perhaps the key organism among natural resources can not be too often emphasized. Its role as the source of wood—one of the few truly basic physical requirements—is often regarded as its sole function. But the indirect or secondary influences of the forest, as we study and understand them, assume greater and greater weight. As a regulator of streamflow and preventor of erosion, the mountain forest is of vital moment to valley agriculture and to the development of hydro-electric power. As a recreation ground it is a social factor of prime importance. As the home of abundant wild life it is of recognized value.

We can assume without argument that forest lands, except where of more value for agriculture, should be kept growing wood. We can likewise take it for granted that the bulk of the timber lands must be used to supply man's needs for wood, but that representative areas, of particular interest, will be retained in their natural condition in parks.

To understand the present condition of Pacific Coast forests, and the part man has played in molding them, we must first examine their status of say a century ago. The typical virgin forest at first glance appears static in its nature, since few changes are evident from one year to the next. But as it is studied, it becomes evident that the forest, like other wild life, does not exist in an undisturbed state of nature. It is not immune to the struggle for existence. Even without the presence of man, fire starting from lightning has been a major factor in the life history of our forests. In the Douglas fir of Oregon and Washington and the western white pine of Idaho and West Montana, fire has often been of a catastrophic nature, wiping out mature timber on many square miles at a stroke. What we know today as the virgin forest has on many areas in these regions come in following such conflagrations. Due to the reproductive characters of the trees, generally the wiping out of the mature forest does not prevent the establishment of a new stand, usually as dense as the stand destroyed.

In the pine regions of California and of eastern Oregon and Washington, the frequent fires of past centuries were not generally so all

*Read at the meeting of Western Division, American Association for the Advancement of Science, Portland, Ore.

inclusive in their destruction. They did not obliterate the forest at a stroke. Instead, an insidious process of attrition operated, whereby occasional individuals and groups of mature timber and much of the young timber growth were killed. Thus the forest was engaged in a constant struggle to reproduce as rapidly as the recurring fires created small openings. On a regional scale, the forest, in California at least, slowly lost out, and areas here and there were captured by brush. Moreover, the forests which persisted were greatly reduced in density and quality. The average best of the stands contained only 40 to 50 per cent of the wood found in the few remaining full stands. Recurring fires also created basal scars through which heartwood destroying fungi gained entrance. These destroyed a high percentage of the accumulated wood in trees which survived the fires, particularly in such species as white fir and incense cedar.

Before the occupancy of the Pacific Slope by the white man, fires were undoubtedly caused by the Indian. It is to be doubted whether he deliberately set fire to the forest in many localities, but no doubt, as a user of fire, he was responsible for at least some of the ancient burns.

At the coming of the whites, then, the Douglas fir forests and the western white pine forests were probably nearly continuous. Due to past holocausts, various even-aged stands occurred, but so far as we know, little forest land had been permanently denuded of tree growth. In the pine, already the forest had been wiped from some areas, and reduced in density on others.

The pioneer breed of man who invaded the Pacific Slope less than a century ago, must have been tremendously impressed with the apparently inexhaustible forest. Certainly he found in it an obstacle, a hindrance to his pursuits. As miner, as stockman, as traveller, as farmer, as hunter, the best forest was an open or non-existent one, and fire was the only tool at hand to accomplish his purpose. Thus the white man naturally became the cause, deliberately or through carelessness, of many fires. At the very least, he lacked both the means and desire to curb fire. The first effect of his activities was probably to accelerate the burning of forest lands, a process already in existence. This was certainly true in California, where fires of the pioneer days wiped out the timber on considerable areas.

The use of wood in pioneer days was slight in the aggregate though even in the seventies local wood famines resulted near mines. As the population of the Coast increased, the business of lumbering started and grew with amazing rapidity, and coupled with fire, the forest now

had the additional direct attack of axe and saw. Logging operations became a cause of fires, which in California pine, were particularly destructive and consequential. The logging did not take nearly all the trees, but left a mass of slash or debris which made fires on cut-over lands most intense and destructive. Frequently the remaining stand was wiped out by a single burn, leaving the land to brush.

In the Northwest, summer fires in slash not only destroyed the remaining trees, but at times the dormant seed, the source of the new stand. Reburns became more common in all probability, and where the stand destroyed had not yet reached seed bearing age, devastation was the result. Single burns were naturally less consequential than repeated burns. In all parts of the Coast forests, the tendency was for fires to become both more frequent and more destructive. Thus the combination of logging followed by fire became a principal means of wiping out forest growth.

Generally speaking, until the beginning of the new century, protection against fire was not attempted. Where buildings were threatened of course efforts were made to control fires, but extensive burns were still common. In California pine, fire itself was used in virgin timber to burn in spring or fall, part of the debris, and thus attempt to reduce the severity of the summer fires.

The federal government, through the Forest Service, began the systematic fire protection efforts on the Pacific Coast some twenty years ago. Other interests—the states, lumber companies and timber land owners—have joined until at present most forest land is covered with some sort of a protection organization. The initial work of the federal government was principally on national forest holdings, though in time the intermingled private lands were also covered as well. Large blocks of private lands were chiefly handled by associations, the primary effort being devoted to mature or merchantable timber, with less attention generally to cut-over lands or young growth.

In spite of strenuous protective efforts, serious fire losses have continued to the present. The difficulty of protection has increased rapidly as more and more fire-using industries and individuals have invaded the forests. The increasing areas of cut-over lands and of old burns, both representing the highest hazards, have added to the task of fire control. In addition to these factors, in the pine region of California, the tradition of burning forest lands to improve grazing or as an attempt to reduce hazard, has persisted. Thus in parts of the Pacific

Slope, deliberately set fires have been added to the total of accidental and lightning fires.

Systematic fire protection has reduced the loss of merchantable timber to a very small, almost minute part of the total stand. Old burns, cut-over lands and restocking brushfields burn over at the rate of 2 to 4 per cent of the total area annually. Fire, caused largely by man's activities, has in spite of noteworthy co-operative progress in control, continued as the chief factor in denuding new areas and in preventing reforestation of the older burns.

Until recently lumbering itself, aside from fire, has not been an important factor in denuding forest lands of tree growth. If cut-over lands did not burn up, a new forest was generally obtained. But with the development of power logging, and with closer and closer cutting of the timber, today in the pine regions generally, logging alone not infrequently results in wiping out the existing forest and the hope of a new one for many years to come.

The present status of our forests can be briefly summarized. An investigation in 1923 showed in the five states of Montana, Idaho, Washington, Oregon and California a total area of forest land of 103,585,000 acres. Of this, 21 per cent or 21,670,000 acres has been deforested, either by cutting or burning, and about 80 per cent of this is reforesting to some degree. Some 4,000,000 acres are thus completely denuded of forest growth, and much of the land called productive, carries only a partial stand of timber. In California the productive cut-over land averages on typical holdings not over one-fifth stocked.

In the yellow pine forests, the stand is still very much understocked, for the natural process of upbuilding under fire protection has operated for an insufficient time to offset the effects of the deteriorating process so long in effect.

Man has thus, so to speak, with one hand wiped out the forest, and with the other, protected and restored it. Certainly the fire protection efforts of the past 20 years have enormously reduced the losses that would otherwise have occurred. None the less, the destructive activities have somewhat exceeded the constructive efforts. There is, on the part of all concerned, recognition of this fact and the most serious attention has been and is being devoted to solution of the problem of maintaining forest lands in productive condition.

Thus to date, man's occupation and use of the western forests has not critically reduced either the amount of standing timber or the area of forest-producing land. Though on a broad regional scale we still

have abundant forest, locally a wood famine already exists. This condition is not found on extensive areas. What has already happened is to be regarded primarily as a warning of what the future holds if we do not alter our way of treating the forest resource. With the bulk of our timber still in the virgin state, we have the opportunity and the duty to avoid the tragic mistake of wholesale deforestation, a mistake for which some of our eastern regions are now paying. More particularly the problem is one of private lands, aggregating 31,145,000 acres.

National forest lands, though requiring additional protection, are permanently devoted to forest production and are handled to produce not only crops of wood but to fulfill the indirect benefits. The methods of cutting employed where mature timber is harvested, are calculated to insure continuation of the land in forest.

Private owners, with some exceptions, are as yet without a settled cut-over land policy. Naturally enough, with enormous reservoirs of virgin stumpage, with a strongly competitive industry, the chief attention has been to rapid and cheap exploitation of the virgin forest. The rapid increase in rate of cutting on the Coast accentuates the need for prompt and effective action. In 1900 the area cut was 105,000 acres; in 1922, 420,000 acres, or four times as much.

Today, fires on cut-over land resulting from logging are still all too common. In spite of much progress, the industry as a whole has not yet fire-proofed its woods operations. That this can be done, and with profit to the operator, as well as with benefit to the forest, is thoroughly demonstrated by those companies which have attempted it energetically. The methods have been worked out and proved.

Disposal of logging slash in some manner is essential in Pacific Coast forests. In the redwood and the Douglas fir regions broadcast burning with proper precautions does not prevent the prompt re-establishment of timber growth. The same practice in the yellow pine region commonly results in denuded land, or in serious reduction in density of the new forest, which comes chiefly from advance growth on the ground at the time of logging. Slash can be disposed of without serious harm to the forest, and at slight expense.

In the redwoods and in Douglas fir a new forest follows logging even if no seed trees are left, and if the advance growth is destroyed. There need be little concern over power logging or clear cutting. But in the yellow pine the situation is totally different. Many of the variations of power logging destroy both young growth and seed trees, and leave little chance for a new forest, except by the very slow process of in-

vasion. Here we must class much of the power logging, as well as clear cutting which leaves no seed trees, as present practices definitely inimical to the forest.

Really the key to the task of keeping the lands productive is in the logging and subsequent treatment of private lands. It is unnecessary to argue that the entire expense of protecting cut-over lands from fire should fall on the private owner, for already the federal government and the states have made substantial contributions toward this end, and maintain organizations which serve in large measure the private holdings. Public agencies have an additional obligation, that of determining methods and practices of growing timber, of finding out how fast timber grows in the different regions and of aiding the industry in shifting from a timber mining to a timber growing program. Forest research, though badly undernourished financially, has made an excellent beginning. Much more is needed.

Even with the existing danger from fire, the real obstacle to many private owners in embarking on timber growing enterprises is a mental one. They fear the future. Part of the barriers are certainly imaginary. Timber grows at least as rapidly in most of the Coast regions as in other forest regions where private timber growing is an accomplished fact. The redwood and Douglas fir have the fastest growth of American conifers. The potential grower of timber though in need of more exact information to guide and reassure him has little real reason to fear that investments in timber growing will be thrown away.

A common argument against private forestry is that taxes on cut-over lands are oppressively high, and are repeated each year, whereas a crop is obtained only twice in a century. The public has a definite obligation to study and if essential remove this barrier, even though it is in part imaginary rather than real.

The fires which menace or destroy the growth on cut-over lands are in large part caused by agencies other than the timber operator. In growing timber he must face this heavy risk, which can be reduced through systematic education in fire prevention and more intensive protection measures, in both of which public agencies should co-operate.

Research should be greatly extended to lay the foundations for successful forest practices in converting the virgin forest to second growth and in restoring denuded lands by planting. Most of such investigations will of necessity be carried on for many years, and can best be handled by existing public agencies.

If the public has its obligations in solving the problem of preventing forest destruction and of growing new wood crops, so too has the owner of forest lands. Because wood is an essential raw material and because the forest affects the farmer, the producer of hydro-electric power, the recreationist, the private owner has the obligation to so handle forests that new ones will follow as the old are utilized. Research and experience both show that this can be accomplished without disruption of existing logging methods and without serious additional cost to the operator. Though it is commonly argued that to prevent devastation is an intricate and costly process, all investigations indicate the contrary.

Whether or not the public asserts in law its undoubted right to declare forest ownership a public trust, carrying the obligation to keep lands productive, depends on the degree to which devastation continues. With the principal practices needed to keep forests growing now fairly well understood, with the public already participating in large measure in financing the essential fire protection and in determining methods of growing timber, further delay in adoption of constructive cut-over land policy can only be regarded as unwillingness to meet the public halfway.

The situation at present calls neither for extreme optimism nor pessimism. It is decidedly a hopeful symptom that the problem of private lands is recognized, discussed and studied by all concerned, and that progress in its solution is being made. On the other hand, existing practices still result in a steady loss of productive area, with impairment of the indirect but essential values of the forest.

PRECIPITATION AND FOREST FIRES IN NORTHERN MINNESOTA

By J. A. Mitchell
Lake States Forest Experiment Station

That the amount and distribution of precipitation has an important bearing on the occurrence of forest fires goes without saying. But just how much rain is necessary to effectively prevent forest fires, or what the relation between precipitation and the occurrence of forest fires is, in terms of inches of rainfall and number of fires no one knows. To arrive at this precisely would involve the consideration of a large number of factors all more or less important. An analysis of precipitation and forest fire data alone, however, shows that there is a direct relation between precipitation and the occurrence of forest fires and indicates in a general way the extent to which precipitation affects the fire situation.

In the present instance the correlation was made for northern Minnesota by ten-day periods, the available precipitation and forest fire data for the fire seasons of 1915 and 1923 inclusive being used. Two methods of correlation were followed.

In the first instance the per cent of the total number of forest fires occurring during ten-day periods with given amounts of precipitation or less, was determined. In the second, an attempt was made to establish the direct relation between precipitation and number of fires by averaging the number of fires occurring during ten-day periods of equal precipitation. The results are shown in Figures 1 and 2.

The wide spread of the data on which the points in these curves are based led to the belief that seasonal differences in the value of precipitation might be a factor worth considering. The data, therefore, were recompiled by seasons and the existence of decided seasonal trends established. See Figures 3 and 4. While the spread of the data on which these curves are based is still considerable and in some instances extreme, distinct and harmonious relationships are indicated.

From Figure 3 it appears that the effectiveness of moderate amounts of precipitation in preventing forest fires is least in the summer and greatest in the fall while the effectiveness of spring rains is intermediate, corresponding closely to the average for the year. This same relationship is indicated by Figure 4 in the case of spring and rain falls.

Fig. 1

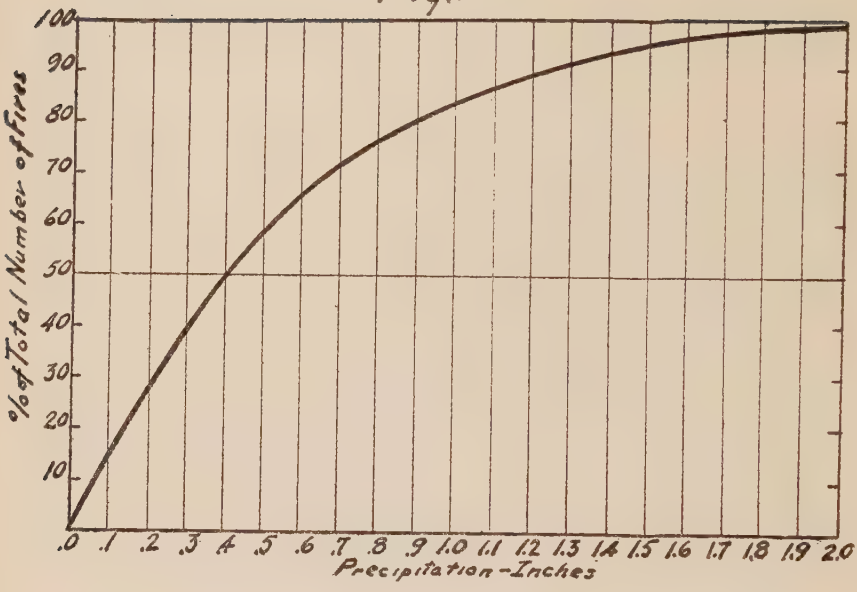

% of Total Number of Fires
100
90
80
70
60
50
40
30
20
10
.0 .1 .2 .3 .4 .5 .6 .7 .8 .9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0
Precipitation - Inches

Fig. 2

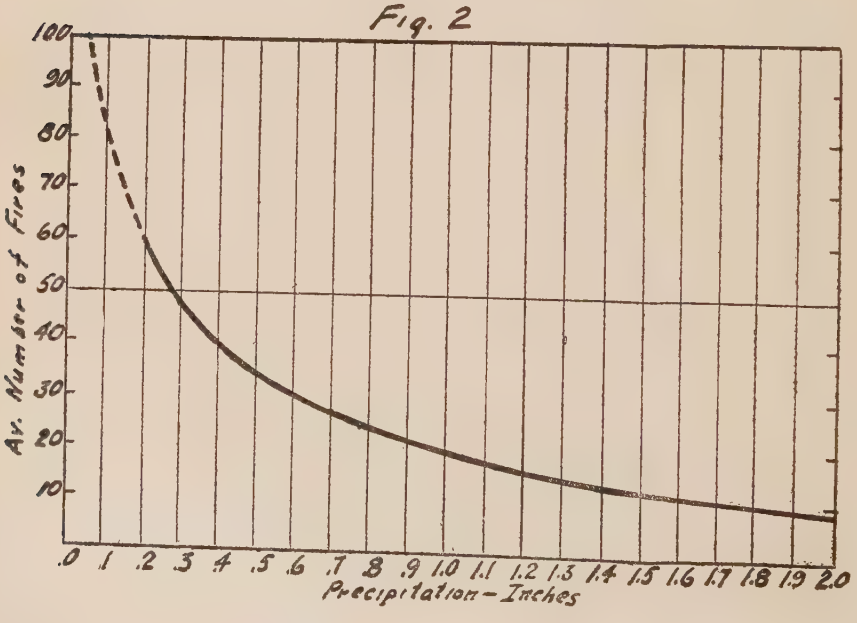

Av. Number of Fires
100
90
80
70
60
50
40
30
20
10
.0 .1 .2 .3 .4 .5 .6 .7 .8 .9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0
Precipitation - Inches

Fig. 3

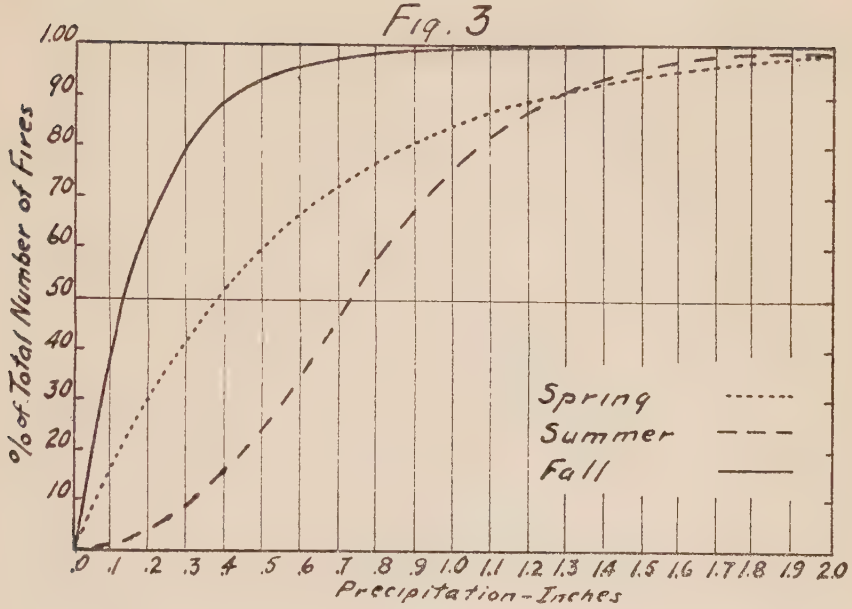
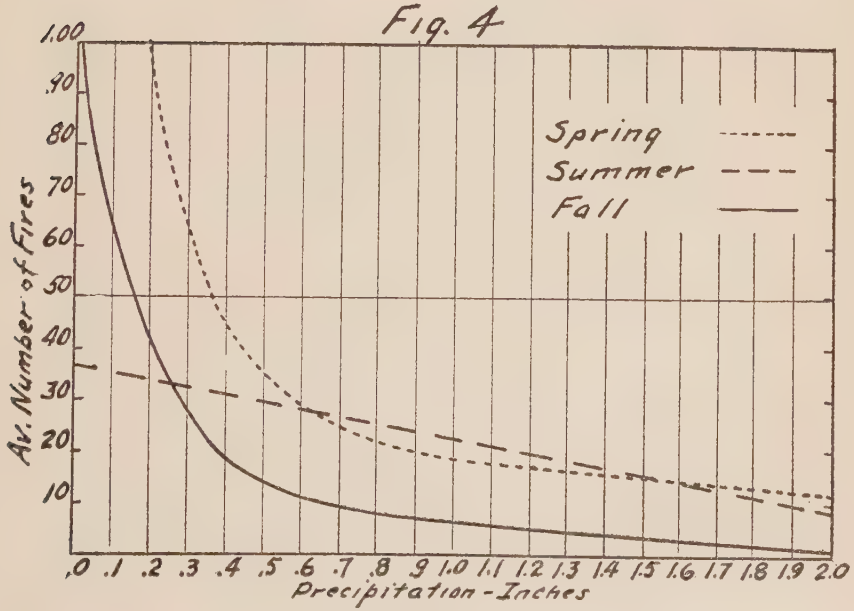

1.00
90
80
70
60
50
40
30
20
10
% of Total Number of Fires
Spring
Summer
Fall
.0 .1 .2 .3 .4 .5 .6 .7 .8 .9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0
Precipitation - Inches

Fig. 4


1.00
.90
80
70
60
50
40
30
20
10
Av. Number of Fires
Spring
Summer
Fall
.0 .1 .2 .3 .4 .5 .6 .7 .8 .9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0
Precipitation - Inches

The lack of harmony of the summer curve with the others in Figure 4 may be due to insufficient data in the lower precipitation groups, or to the fact that the fire situation is controlled by some factor or factors other than precipitation during the summer months.

Returning to Figure 3, it is of interest to note that while in the summer precipitation amounting to less than .5 of an inch in ten days is apparently of little effect in keeping down fires, in the fall .5 of an inch is 95 per cent effective. Doubtless this is due in part at least to the fact that during the summer light rains are intercepted by vegetation and evaporated before they reach the duff and litter in which most fires start. Lack of effectiveness in the case of summer rains, however, is usually more than offset by an abundance of precipitation.

Based on Figure 3 the approximate amounts of rainfall required at different seasons to produce equal results in the way of preventing forest fires are as follows:

EFFECTIVENESS OF RAINFALL

Degree of Effectiveness	Fall	Spring	Summer
	Precipitation—Inches		
25%	.05	.15	.50
50%	.15	.40	.75
75%	.25	.75	1.00
90%	.40	1.25	1.25

While the above correlation is crude, being based on state-wide averages of rainfall and forest fires and on arbitrary ten-day periods, it serves to indicate the relationship that exists between precipitation and the occurrence of forest fires in northern Minnesota and is presented for what it is worth.

A MODIFICATION OF THE FRENCH METHOD OF 1883 FOR APPLICATION TO AMERICAN SELECTION FORESTS OF MIXED TOLERANT SPECIES*

By Harold Cahill Belyea
New York State College of Forestry

Probably one of the greatest problems met by foresters in the practice of their profession in this country (i. e., the production and development of successive crops of timber), are those involved in the application of forest regulation and forest management to mixed selection forests of more or less tolerant species. This is particularly true in the northeastern part of the United States and in eastern Canada, where all aged stands composed of both coniferous and hardwood stock occupy probably not less than 75 per cent of the productive area of the forest. The crux of these difficulties has been centered in the calculation of actual growing stock and actual increment with the consequent troubles involved in the computation of such annual or periodic cut as may approximate the regulation of the area on something approaching a sustained yield basis.

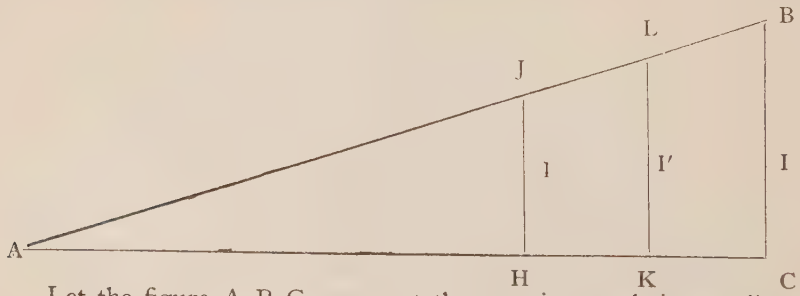
European experience and practice has long anticipated and made solution of the vexing problems which beset the path of the forester. It is to be remembered that in the technical solution of any forestry problem the endeavor is rather to illustrate a principle than to establish a practice. Hence as long as the principle is maintained minor variations in the actual practice as are adapted to local conditions are perfectly in order.

Among the European methods developed that known as the "French Method of 1883" seems especially adapted to mixed, all aged forests composed of a number of tolerant species. In application and practice it has one severe drawback, namely, that it requires an exact tally of the stand inclusive of all trees down to an age equal to one-third of the rotation. Examination of any tally record in mixed, all aged forests on the basis of composition and site will quickly reveal

* The writer more or less stumbled into this idea while working on a modification of the Swiss Method for application to American mixed hardwood forests. It was written up about as is for presentation to the Journal but was withheld when it was found that practically the same idea had been anticipated by E. A. Smithies, of the Indian Forest Service, and published by him in the September, 1925, issue of the Indian Forester. In response to Woolsey's invitation in the December, 1925, issue of the Journal the article is herewith submitted.

the inordinate difficulties to be encountered in meeting the field and office specifications of this method. These difficulties are so great in actual practice that the adoption of the method seems to be forbidden. Two strong forces necessary to the successful management of the forest are immediately placed in opposition. One in the insistence of the technician that merchantability is a matter of age. And the other, equally insistant, and that of the man most concerned in the actual harvest of the forest crop, the lumberman, that merchantability is not a matter of age, but of size. And of the two it would seem as if the logger had the better of the argument. For while young trees of an age of one-third of the rotation may be potentially merchantable, when one comes down to the hard business of converting timber into lumber, a tree that will not pay its own way from stump to mill, let alone to the ultimate consumer, can hardly be termed a merchantable tree.

The answer is to disregard the factor of age as a factor of merchantability and concentrate on size. It is to be remembered that, under the French Method of 1883, the classification of all trees less than one-third the rotation age into the unmerchantable or young wood group is purely an arbitrary measure, and is only a means to an end, namely: of determining the comparative volume of the unmerchantable merchantable part in the stand for the purpose of gauging the standard of normality and for purpose of so allocating the cut, that definite progress toward equalized yield may be achieved. And in this determination of ratios, the real standard after all is merchantability. Keeping this in mind the field work and office computation is greatly simplified since trees need be tallied down only to a predetermined standard: minimum d. b. h. limit, irrespective of age, site, rotation, merchantable age or condition. Subsequently the ratio between mature and over-mature wood may be computed the standard of normality determined and the annual yield calculated.



Let the figure A B C represent the growing stock in an all aged forest approximately normal.

Granting the normality and its alleged character it will contain on every acre aggregates of young wood, average wood and old wood, whose respective total volumes shall be in the approximate proportions of 1:3:5.

Let AC = R, the rotation age.
AH = a, the period of reproduction, that is the age when trees grow into merchantable size.
AK = r, a hypothetical age when the trees through growth and development pass from the average or mature wood into the old wood or veteran class.

Let BC = I, the Mean Annual Increment at R years.
LK = I′, the Mean Annual Increment at r years.
JH = I″, the Mean Annual Increment at a years.

Let the triangle AHJ represent the volume of the growing stock included in the *young* wood.
the trapezoid JHKL represent the volume of the growing stock included within the *average* wood.
the trapezoid LKCB represent the volume of the growing stock included in the *old* wood.

Then the proportion we seek can be represented by the ratio

Triangle AHJ : Trapezoid JHKL : Trapezoid LKCB

Solving first for the value of the old wood class represented by the trapezoid LKCB.

$$\text{Trapezoid LKCB} = \text{Triangle ACB} - \text{Triangle AKL}$$

$$= \frac{BC \times AC}{2} - \frac{LK \times AK}{2}$$

$$= \frac{I \times R}{2} - \frac{I' \times r}{2}$$

But these are similar triangles, hence

$$BC : AC :: LK : AK$$
$$\text{or } I : R :: I' : r$$

$$\frac{I}{R} = \frac{I'}{r}$$

$$\text{and } \frac{Ir}{R} = I'$$

Substituting in the above

$$LKCB = \frac{I \times R}{2} - \frac{\frac{Ir}{R} \times r}{2}$$

$$= \frac{IR - \frac{Ir^2}{R}}{2}$$

$$= \frac{\frac{IR^2 - Ir^2}{R}}{2}$$

$$= \frac{IR^2 - Ir^2}{2R}$$

$$= \frac{I(R^2 - r^2)}{2R}$$

Similarly trapezoid JHKL = triangle ACB − triangle AHJ − trapezoid LKCB.

$$= ACB - AHJ - LKCB$$

$$= \frac{AC \times CB}{2} - \frac{AH \times HJ}{2} - LKCB$$

$$= \frac{I \times R}{2} - \frac{I'' \times a}{2} - LKCB$$

But by similar proof as before $I'' = \frac{Ia}{R}$

Hence $$JHKL = \frac{I \times R}{2} - \frac{\frac{Ia}{R} \times a}{2} - LKCB$$

$$= \frac{IR}{2} - \frac{\frac{Ia^2}{R}}{2} - LKCB$$

$$= \frac{IR - \frac{Ia^2}{R}}{2} - LKCB$$

$$= \frac{\frac{IR^2 - Ia^2}{R}}{2} - LKCB$$

$$= \frac{IR^2 - Ia^2}{2R} - LKCB$$

$$= \frac{I\,(R^2 - a^2)}{2R} - LKCB$$

But $LKCB = \frac{I\,(R^2 - r^2)}{2R}$

Hence then trapezoid $JHKL = \frac{I\,(R^2 - a^2)}{2R} - \frac{I\,(R^2 - r^2)}{2R}$

$$= \frac{I\,(R^2 - a^2) - I\,(R^2 - r^2)}{2R}$$

$$= \frac{IR^2 - Ia^2 - IR^2 + Ir^2}{2R}$$

$$= \frac{Ir^2 - Ia^2}{2R}$$

$$= \frac{I\,(r^2 - a^2)}{2R}$$

Finally in the triangle AHJ representing the volume of the *young* wood.

$$AHJ = \frac{JH \times AH}{2}$$

$$= \frac{I'' \times a}{2}$$

But $I'' = \frac{Ia}{R}$ as before

Hence $AHJ = \frac{\frac{Ia}{R} \times a}{2}$

$$= \frac{\frac{Ia^2}{R}}{2}$$

$$= \frac{Ia^2}{2R}$$

Hence the ratio:

Triangle AHJ : Trapezoid JHKL : Trapezoid LKCB

becomes $\frac{Ia^2}{2R} : \frac{I\,(r^2 - a^2)}{2R} : \frac{I\,(R^2 - r^2)}{2R}$

or $a^2 : r^2 - a^2 : R^2 - r^2$

and in the normal forest these will be as 1 : 3 : 5.

Exactly the same result can be gotten by directly solving the problem on the basis of its component trapezoids.

But we are not particularly interested in the status of the youngest age group only that there be sufficient amount of it to promise replacement. Hence having gotten the volume of the stand on the basis of its merchantability let us divide this merchantable portion into two groups which shall be to one another as 3 : 5, volume of course being the basis of the ratio. The older five-eighths we will call the veteran class and the younger three-eighths the mature or middlewood class.

Then the application of the method of regulation approximating the French method of 1883 is simplicity itself. All that is required is a tally and determination of the volume of all the trees considered merchantable under the current standards of utilization. This tally must perforce include both the mature wood and the old wood, the average and the veterans. Then having determined R and a, divide the tallied portion of the stand into two parts on the basis of the proportion of 3 : 5. The annual cut is then equal to the volume included in the "old wood" or veteran class divided by the number of years in the period of reproduction plus one-half of its increment for that period. Expresssed in a formula this becomes

$$\text{Annual cut} = \frac{V + \frac{Ia}{2}}{a}$$

Where V = the total volume in the old wood class
I = The mean Annual Increment for the old wood class
a = The number of years in the period of reproduction

In conclusion the following may be pointed out regarding the method:

1. It is extremely simple in its conception and application, since it involves nothing more than a consideration of the merchantable volume of the stand, a determination of the period of reproduction, and the length of the rotation and a proportional division of the actual merchantable portion of the stand on the basis of 3 : 5.

2. The pro-rating of the cut in the old wood over a period equal to age of reproduction, "a" years, is based on the assumption that it will take that length of time to secure adequate regeneration in replacement of the portion removed in the cutting.

3. At the end of "a" years the property should be re-examined and a merchantable portion of the stand determined.

4. Under strict application of the Method of 1883, "a" is equal to one-third R. It is believed that in the regulation of wild forests the best results can be obtained by approximating "a" to one-third R. The closer the forest draws towards normality, the nearer these figures will approach until they merge.

5. It is to be remembered that the value "r" is entirely fictitious and enters into no part of the computation of the merchantable portion of the stand nor the calculation of the yield. As an arbitrary value between "a" and "R," the position depends entirely upon the degree of normality and the proportion of the growing stock included within the old wood.

6. The method obviates objections urged against the Method of 1883 in that no requirement is made to tally the trees down to one-third the rotation age. Being based on size rather than on age, the greatest elasticity is permitted in the consideration of what portion of the stand shall be considered as fit for regulation and use.

7. The method is believed to be elastic since being based on the factor of merchantable size and volume, it can readily adapt itself to changes in closeness of utilization (i. e., the harvesting of smaller diameter classes) or variations in the rotation assumed.

8. It is believed that this method is adaptable to such conditions as are met with in such selection forests as those of the Mixed Adirondack Hardwoods type, and other similar types.

9. It is admitted that this modification does not meet with Woolsey's objection (American Forest Regulation—by T. S. Woolsey, Jr., page 84), in that no check is suggested or devised on the absolute normality of the old wood. This weakness is inherent in any method which disregards some conception of total volume.

THE FUTURE OF FOREST LANDS IN MONTANA AND IDAHO*

By Elers Koch

A forester, by virtue of the crop he grows, is obliged to forecast the future. He plants pine seed in the nursery, his sons make the first thinnings in the planted stand, and his grandsons, if they live long, harvest the final crop of saw logs and again reproduce the stand for their grandsons to cut. It is only by projection of his mind into the future that the forester can endure the thought of the slow accretion of his crop; five—ten—twenty annual rings to the inch radius, and a decade to grow to the height of his shoulders. Few of the trees we are now marking to cut are not older than the American nation.

We foresters here in Montana and Idaho have been on the job for perhaps twenty years. We have seen many green timbered valleys cut off to the last merchantable tree. Always we must go further afield and higher into the hills to find virgin timber stands left, and the second-growth stands on the oldest cut-over lands are still but thickets for the deer to hide in.

Should we not then project our minds into the future and ask what will the next 20 or 30 years show? How much timber will be left in the region? Where will the mills get their supply of logs? What will the second growth amount to then? Who will own the timberlands, and what sort of silviculture will the owners practice? What will the different species of the region then be worth?

The answers to all of these questions will have a profound influence on all of our forestry practice today, our form of silviculture, our choice of species, our investment on each acre in cultural measures, the character of our forest improvements, the advice we give as foresters to the owner of timberland. It is true that no one can certainly predict the future, but we can analyze the trend of affairs and at least make some sort of intelligent forecast as to what will happen. At any rate, the forester who can see nothing but today's conditions is certainly not going to proceed in the right direction. One is continually obliged to make decisions on action today based on one's best judgment of conditions many years in the future.

I am going to confine my speculations mostly to the Northern Idaho and Western Montana region because the region is well known

*Presented before the Northern Rocky Mountain Section, Society of American Foresters, Feb. 8, 1926.

to me and to most of you, and it is much easier to see what lies ahead in a limited, well-known region than in the country as a whole, although we must not lose sight of the fact that the National Forest situation will have much influence on conditions in any locality.

The most tangible fact which can be utilized in a forecast of the future timber situation is the available supply of timber and its relation to the rate of depletion. Fortunately for North Idaho and Montana we have fairly authentic data on timber stand and acreage compiled by the Forest Service, and, of course, the census figures are available for the annual cut.

In determining the rate of exhaustion of the timber supply in any region, one can not simply divide the total stand of timber by the annual cut. The question of ownership and management policy must be considered. The timber in Idaho is chiefly divided between the state, the private owner, and the National Forests. The state of Idaho is practicing pretty good silviculture and is protecting the state forests from fire, but from present indications will not undertake a sustained yield. It seems probable that the bulk of the state timber will be sold and cut through about the same period as the private holdings.

In 1923 the lumber cut in North Idaho mills was 883,000 M feet. The 1924 and 1925 cut for the state was about the same, and as I do not have the North Idaho cut segregated for that period I am using the 1923 figures.

In addition to this about 114,000 M feet was sawed in Washington mills from logs cut in Idaho, making a total lumber cut from logs produced in the state north of Salmon River of 997,000 M feet. Of this amount 58,000 M feet was cut from the National Forests. The annual drain on the private and state timber is then about 939,000 M feet. The best estimates available indicate a total stand in North Idaho of 6,260 million board feet of state timber and 22,594 million M feet of private. Dividing the cut into this estimate indicates a life of 31 years for the private and state timber of North Idaho, if the present rate of cutting continues. This calculation does not take into account overrun in log scale which will be largely offset by fire and insect losses, loss of timber in driving and use of timber for logging improvements, and by consumption of mine timbers and other products not included in the lumber cut.

What will probably happen will be the successive cutting out of one section after another beginning at the north end of the state. Bonner and Boundary counties will go first, and Pend Oreille county, Wash-

ington, about the same time. Fifteen years will see the private timber in these counties practically gone with most of the sawmill industry which supports the towns of Bonners Ferry, Sandpoint, Priest River, Newport, and Ione. The sustained yield of 54 million feet from the Kaniksu and Pend Oreille forests will support only a small percentage of the present mills. This is going to be a hard blow to those counties, since the lumber industry is their main support and the amount of agriculture comparatively limited.

The private timber in the Coeur d'Alene Lake region will not last more than 20 to 25 years. When that is gone the region must come down to the cut of the Coeur d'Alene and St. Joe forests, or about 80 million feet.

The Clearwater region is in for a lumber boom. The construction of the new dam and sawmill by the Clearwater Timber Company at Lewiston, and the extension of the N. P. from Orofino through the main body of Clearwater white pine will mean a general moving of the lumber industry toward that part of the state and probably an increase in the total lumber cut for the state of from 15 to 25 per cent for the next few years until some of the north end mills begin to drop out for lack of stumpage. The Clearwater will be the last stand of the lumber industry in North Idaho, but 30 years will see the private and state timber largely gone. There is some question as to what extent the Clearwater, Selway and Nezperce National Forests can fill the gap. These three forests have a theoretical annual limitation of 150 million feet, but much of their timber is very inaccessible and of low quality, and it may not be possible to exploit it by that time.

Western Montana is cleaning up its private timber at about the same rate as Idaho. At the present rate of cutting the privately owned timber in Western Montana will last about 33 years. Thereafter the sustained production of the National Forests will permit an annual cut of 210 million, or less than half the present cut.

The state of Washington, which now leads in lumber production in the United States, has only about 30 years' cut of private timber, although the rapidity of growth in that region makes the possible cut from second-growth stands a good deal more of a factor than it will be in Montana or Idaho.

Oregon and California are the two states in the Union which really have a reserve of timber far beyond the present cutting rate, but the total of the privately owned timber in each of these states is but very little greater than the State of Washington has left, and their rate

of cutting will, doubtless, very rapidly increase. New sawmills, new paper mills, and new railroad extensions are being projected and built at a tremendous rate.

The purpose of presenting these figures is to bring home the fact that local exhaustion of stumpage supplies even in the Northwest states, the last reserve, is already closely impending, that important mills will begin to shut down from lack of stumpage within 10 to 15 years, and that 30 years will see little timber left in the states of Montana, Idaho and Washington, except in the National Forests, and the sustained yield from the National Forests will not be sufficient to maintain anything like the present rate of cutting even if market conditions make it possible to cut the full theoretical yield from the low-value inaccessible stands on the forests.

This will mean toward the latter end of the 30-year period greatly increased concentration of the remaining private timber in the hands of a very few large companies, and the keenest kind of competition for stumpage from the mills, which are about cut out and facing the necessity for a final shutdown. The prediction made by Dr. Wilson Compton, Secretary-Manager of the National Lumber Manufacturers Association, looks reasonable, which was that in 1930 Douglas fir stumpage will on the average be between $8 and $10, and within 10 years thereafter between $10 and $18. What Idaho white pine will be by 1940 the Lord only knows, but I only wish I had a few thousand acres of young white pine reaching maturity about that time.

The problem of the low-value mixed species, which is now giving the foresters of this region so much trouble, will naturally solve itself in time. I do not look for very much improvement in the next three or four years, but certainly within 10 years the decreasing production in the South and the increasing logging costs on the Coast, and the greater concentration of stumpage holdings ought to begin to make itself felt in lumber prices in this region, and lift the value of white fir, hemlock and larch from a general negative quantity to a considerable positive value.

Since the next 30 years' cut will pretty well clean up the timber on privately owned land in Montana and Northern Idaho, the question of what will happen to those lands is a matter of much moment.

In order to encourage the forestry movement in the country foresters have perhaps properly looked on the favorable side of things and in public statements and other propagandist material have stated the

possibilities and probabilities of the practice of forestry in the most optimistic manner.

I just came across a statement in a recent magazine article by a man named James Stevens, which seems to me to carry a good deal of truth. He says, "In America Fact is too often a poor Cinderella, a neglected maiden who sits alone at the fireside, while her gaudy sisters, Sensation and Propaganda, are the belles of the ball, where the favors of that modern prince, Publicity, are to be won. Fact has no fairy grandmother and she is a plain maiden who wears adornment badly anyhow."

In a discussion of this sort between professional foresters we may forget propaganda and come down to facts as far as possible, and really attempt to analyze the situation in a critical manner, and so far as we can see into the future attempt to predict what will be the history of the forest lands of the region in the next half century and the development in the practice of forestry by the timber owners. There is nothing to be gained from our standpoint in allowing our desires to influence our beliefs or in kidding ourselves into believing things which the true facts will not support.

I am willing to concede that in public statements foresters should be optimistic. There is a danger, however, that overstatement will cause a reaction and reduce the confidence of the timber owner in the accuracy and common sense of the forestry profession, when he acquires enough knowledge to check up on the facts. The most common form of misleading statements is a citation of actual yields from a limited area of specially high-class sites with the implication that this is a general indication of what timber owners may expect. Some articles written by foresters for the public press have been about on a par with what we might expect in the prospectus of a wildcat real-estate promotion scheme. The fact that such articles are written from a mistaken idea of advancing the cause of forestry rather than for personal gain saves the author from charges of personal dishonesty, but no industry can grow which is based on irresponsible statements of enthusiastic promoters rather than on cold-blooded investigation of its financial soundness.

Forestry is a business the same as any other capital investment. Sometimes it will pay and sometimes it will not, and in the long run its progress will not be helped by distortion of facts.

Considering the situation in Idaho north of the Salmon River, let us first see how much forest land there is in private ownership, and

who owns it. Using the figures recently compiled by the Forest Service, and considering only land classed as merchantable timber, or cut, or burned, we find there are 2,908,000 acres of such land, of which 1,419,000 are merchantable timber, and 1,489,000 cut or burned. That, by the way, is an interesting figure, showing that 25 years after the lumber industry really started, about 1900, half the private forest land is classed as cut or burned, and this does not take into account land cleared for cultivation. We have been accustomed to thinking of the forest-land problem largely as one of the lumber companies, but the figures show that 1,505,000 acres, or slightly over one-half, belong to miscellaneous owners of less than 5,000 acres. Four hundred and twenty-eight thousand of this were listed in the Farm Census as wood lots.

The figures previously presented show that most of this private land will be cut over within 30 years, and that large regions will be completely cut out within 15 years. When the holdings of the individual lumber companies are analyzed the figures are rather startling. There are only three operating lumber companies in North Idaho whose present holdings will afford them a cut of 12 years or more, and no concern with a cut of more than 30 years. Some of these mills will doubtless prolong their lives somewhat by purchase of other holdings, or with National Forest and state timber.

Most lumber companies in the United States which are beginning to do something with the forestry idea are doing so with a sustained yield in mind, which will give their operations a continuous life. Silviculture without a continuous yield is, of course, possible, but it is difficult to conceive of a lumber company cutting out their timber and then holding on to the organization for 20 or 30 years waiting for a new crop of timber to grow and permit them to resume operations.

Regardless of theoretical figures which normal yield tables may show, no one who is really familiar with the Idaho white pine region will expect to grow a merchantable crop of saw timber in less than a rotation of 80 years or more on average land. We all know that in spite of a few exceptions on specially good sites, the general run of 60-year stands is nothing more than large poles, and it is out of the question for a sawmill industry, either now or under conditions approaching present European practice, to be maintained on timber of such size. The usual rotation for coniferous timber in Europe is from 80 to 120 years. Even now in New England, where we have been hearing about fabulous yields of white pine on extremely short rotations, they are beginning to realize that there is not much in this small

low-grade timber. They can not even compete with West Coast lumber. As Prof. R. T. Fisher of Harvard University has recently stated it, in a discussion of the New England timber-growing situation, there is a necessity for "cutting only larger, older timber. Low grade is always the difficult thing to sell. Small timber means high costs and a low yield of better grades. Too much timber is being cut that is not only hard to market for these reasons, but would be making more money for the owner if left standing. . . . The place to start grading is in the woods before the timber is cut."

I would, therefore, put the minimum saw-timber rotation at 80 years for the white pine type, and considerably more for the larch-fir and yellow pine types. Now what is the probability of a supply of young timber reaching merchantable size about the time the mills of North Idaho generally begin to cut out 15 to 30 years from now? We find from the census figures that timber cutting in Idaho did not begin on any extensive scale until after 1900. Consequently, there is very little second growth available on cut-over lands which is more than 25 years old. There is a considerable amount of burned-over land bearing reproduction, a good deal of which dates from the 1889 fires, and is, consequently, about 35 years old. The amount of 40, 50, or 60-year-old stuff in the state is extremely limited. It does not, therefore, appear that second-growth timber will be much of a factor as a saw-timber supply in less than 45 to 50 years from now.

I will, therefore, make the prediction that during the period between 15 and 30 years from now the lumber cut of North Idaho will be greatly reduced, and many mills will go out of business altogether. The annual cut will come down to the sustained yield possibilities of the National Forests plus a limited amount of pick-up from odd corners of private holdings, and a little cut from second growth on good sites. The same situation will develop in Western Montana in about the same period or possibly a little longer on account of concentration of ownership.

Whether this reduction will be permanent or only temporary depends largely on the success of fire protection on the cut-over lands. The state of Idaho now has a very good forest law, which provides for compulsory fire protection and compulsory slash disposal. How effectively this law can be enforced remains to be seen. We have learned a good deal about law enforcement from the Volstead Act, and it seems reasonably certain that a law can not be enforced without general public approval of its provisions. The first year of the compulsory pile and

burn law resulted in piling and burning the slash from about 20,000 M feet, or about 2½ per cent of the annual cut. The balance of the slash was either broadcast burned or left. Presumably this record will be improved in the future, but I am very sceptical of the possibility of enforcing a law requiring piling and burning slash unless the operators are back of it and ready to do it because they want to do it.

At the present time I do not believe there is a lumber company in Idaho which has any real serious intention of cutting its timber and handling the slash disposal with the purpose of growing another crop of timber. If the pile and burn law is effective it will be because operators are convinced that it is worth while as a fire protection measure for their standing timber and improvements. Possibly some of the larger outfits with many years' cut of timber ahead may come to good piling and burning. I personally believe it would be good business for such companies to pile and burn all their slash. This is particularly true in stands which contain a considerable percentage of other species than white pine. Under present practice of broadcast burning slash it comes down to a choice of taking the stuff out now at a loss or a very small profit, or leaving it to burn up. With the slash piled and burned a company could concentrate its cut on the profitable white pine and come back 10 to 20 years later and perhaps make a profit on the mixed timber. Some few concerns will recognize this, and act accordingly, but I am afraid all the timber in Idaho will be cut before some of the conservative lumbermen change their present practice, law or no law, and if the slash is not disposed of by piling and burning it means a continually increasing acreage of land temporarily or permanently devastated by fire. In Montana the lumbermen are very generally burning their slashings with disastrous results to forest growth, particularly in the yellow pine type. The present Montana slash-burning law, which results in general broadcast burning, is nothing less than a crime, and should be repealed at once.

If we make an honest forecast based on what we can see from the trend of the times, and not on what we would like to see, we may as well accept the probability that most of the remaining timber in Idaho and Western Montana will be cut without any very considerable modification in present practice, and that the development of private forestry in the region will not begin with the virgin stands, but will rather be based on the salvage left in the way of accidental second growth on the cut-over lands, and the wreckage of culled stands which have not burned.

I do not think that the North Idaho and Western Montana region will ever be left in as bad shape as the forest lands of the Lake states, first, because there is a real effort being made to handle the fire situation, and second, because we are now cutting in our last reserves of virgin timber, and there will be no new forest areas to move into, as was the case when the Lake states were cut off. If the next generation wants timber at all, people will have to think in terms of second growth.

There is a lot of good second growth in Idaho and Western Montana between 20 and 35 years old which has so far escaped fire, and the probabilities are that a good deal of it will come to maturity in time.

The first step in forestry in this region will be to preserve and protect some of the residual stands left after logging, with the expectation of a second cut. The second step will be recognition of the value of second growth which is far enough along to show a probable sale value in the present generation. Few individuals or even corporations are much interested in returns 75 or 80 years from now. If they were we would see more people compounding savings accounts for their grandsons' benefits. But when the time is cut down to 20 or even 30 years to reap a good harvest, men begin to get interested. Young stands now 30 years old, particularly in the white pine type, will probably have a pretty good speculative sale value 20 to 25 years from now, even though not mature, and the owners are soon going to commence to realize that, and to value such stands accordingly, and to give them the best protection possible.

These first two steps—the protection of residual stands left after logging, for a second cut, and the recognition of the value of second growth will be made soon by some owners; probably not by a majority of owners.

This does not, however, offer any particular hope for the vast areas now cut and burned and either not reproducing at all or with only very young reproduction. Certainly there is a very great deal of such land on which the owner will not consider paying taxes and fire protection costs for the purpose of growing a new timber crop on them after they have cut out their present merchantable timber holdings. It is too long a time and too uncertain an investment to tie up money with no intermediate returns.

Nearly everyone who knows Idaho conditions agrees that the protective associations will fall to pieces when the merchantable timber

of the members is nearly cut out. The land owners will then have no incentive for protection from fire except to protect the cut-over land values and because the state law requires protection. If the state takes over the protective organization it can not hope to give adequate protection for less than 10 to 25 cents an acre. Add 10 cents an acre taxes to this and only the best land with 30 or 40-year-old reproduction on it or with possible agricultural values will appear worth holding to the individual or corporate owner.

The owners will not want these lands, the county does not want them, neither does the state. I can see nothing for it but for Uncle Sam to step in and take over some of these long-term investments for the public good.

As previously stated, there are in North Idaho about 2,908,000 acres of forest land, including merchantable timber, cut-over and burned. Four hundred and twenty-eight thousand of this are in wood lots and presumably will more or less take care of itself. This leaves about 2,500,000 acres as the problem. Nearly 1,000,000 acres of this are inside the boundaries of the present National Forests and should certainly be acquired. Of the remaining 1,500,000 at least 1,000,000 acres are in close proximity to the National Forests and could be logically and economically handled by the forest organization.

Western Montana contains about 2,500,000 acres of good forest land in private ownership, of which about 1,000,000 acres are in the forest boundaries and the rest immediately adjacent. I hope to see the federal government acquire around 4,000,000 acres of land in these two states. Most of it is highly productive, on the average better than three acres of the present National Forest land. The federal government can make a valuable and productive property of it. Left alone two-thirds of it will become non-productive, and a burden to the state and counties. This land could be acquired now, and as fast as the timber is cut off, for about $5,000,000. Under reasonably good management it could easily be made to produce 800 million feet a year, say, $4,000,000 a year gross, with an annual expense of about $1,000,000. It looks like a good investment, but it involves carrying the land for about 40 or 50 years before much if any returns come in, and there is where the individual owner is going to weaken.

If one looks at a map of Idaho and Western Montana it might be easy to conclude that the federal government already holds enough forest land. The National Forests occupy a pretty big percentage of these states. But to the forester, who is familiar with the situation,

it is an aggravation that the Forest Service has in general only the tag ends, the upper slopes and the mountain tops to grow timber on, while the foothills and the valleys, where the real productive timberland is located, are in private ownership. Less than one-third of the area of National Forest land in District No. 1 is classed as merchantable timber and less than a quarter of this is timber which now has a positive value of as much as one dollar per thousand. The National Forests need to be rounded out by the acquisition of most adjoining private land. It will in the long run be a blessing to the states and the local communities, and is the real solution of the forestry problem in this region.

I do not wish to be understood as taking the position that all private forestry in this region is hopeless. Circumstances in each case must be considered. If the largest timber-owning company in Idaho were to call me in as a consulting forester I would say to its officials something like this: "You have about 30 years' cut ahead of you. You have a tremendously valuable body of white pine timber with a high fire hazard. Your logging operations are going to increase that hazard. The thing for you to do is to pile and burn your slash on about the same standard as the Forest Service, and keep all fire out of your holdings. This will cost you about one dollar per thousand, but it is worth it for the safety it will give your timber, your logs and your improvements. You have a large amount of mixed timber with your white pine. Cut only the white pine on which you can make a good profit, and as much mixed timber as you have to have to balance your yard stock. Leave all the rest of the mixed, and when you have cut all the white pine, come back and get it, and you can probably make a good profit on it at that time instead of handling it now at a loss.

"When you have cut all your timber 30 years from now, you can decide then what you want to do. Instead of a worthless burned area such as the white pine operators have been leaving behind them up to the present, you will have a producing timber area, with a lot of nice white pine reproduction coming on and a national timber famine impending to give it value. The second growth will be too young to cut, but it will soon have a good speculative value. Perhaps there will be some older patches of second growth intermingled with your holdings which may return enough to carry the taxes and fire protection on the property until larger areas reach maturity. At any rate it is a pretty fair speculation."

On the other hand, if the average white pine operator with only 5 to 15 years' cut ahead asked my advice, I would say, "Pile and burn your slash to comply with the state law, and for the safety of your operation. Leave your mixed stuff on the ground in the hope that you can come back for it later. Get rid of your cut-over lands as fast as possible, and get out from under the burden of taxes and fire protection. If you can't do any better, make a gift of them to the federal government. Your carrying costs every three to five years will eat up any sale or exchange value such lands may have. Your operation is too short-lived to pay to hold such lands as a speculation. If you happen to have any 30 or 40-year-old white pine reproduction, hold on to it, for it will be worth money in your lifetime, but get rid of the rest."

In Montana there is one very large timber owner, with over 800,000 acres of forest land, and about 50 years' cut, who really has an opportunity for profitable forestry. Most of the timber holdings are in the yellow pine or larch-fir type. If I were called on to advise this company, I would say, "You have a splendid opportunity for a permanent operation. You should practice as intensive forestry as any on the National Forests. Employ a good technical forester and mark all your timber for cutting, leaving at least 20 to 25 per cent of the volume in young thrifty trees. Pile and burn your slash at least in part and keep out fire. By the time you have cut over the land once you can come back again, and you will have a permanent operation which will keep your mill going forever, and the stockholders will be pleased."

Unfortunately, this company is now cutting its land as closely as possible, and in compliance with the absurd Montana law, sets fire to most of it and burns up all the small stuff left. It is a golden opportunity wasted.

In nearly all cases I would advise the owner of white pine or yellow pine second growth 30 years or more of age, to hold it and protect it, if his financial resources will permit holding on for some years.

A word might be said about the future outlook for the National Forest timber. The cut for District No. 1 in 1925 was 148 million feet, with a value of $690,000. Within the next four or five years this cut will probably not be increased, since it will be the policy not to push timber sales. The receipts may fall off somewhat, since the 1925 cut included some specially high-value white pine.

It can not be expected that the annual cut will increase very appreciably until the values of species other than white and yellow pine begin to move upward. It should be remembered that out of 54 billion feet of National Forest timber in the District only 10 billion feet are made up of the valuable pines. Perhaps 30 years from now the District may approach its estimated sustained yield of 640 million. The average stumpage price will probably not greatly increase, since we will be cutting less and less desirable species and more and more inaccessible timber. We can perhaps look for an average stumpage price of four dollars per thousand, which would produce an annual return of $2,660,000. This, with the grazing receipts of $160,000, will much more than put the District on a self-sustaining basis so far as operating costs go. In the fiscal year 1925 operating costs were $1,349,000. This should not be increased very appreciably except on the basis of about 35 cents per thousand for additional sales business, or, say, $125,000 more. My guess is that without an increase in grazing fees, District No. 1 will begin to pay operating costs in about 10 years and by 1950 or 1960 will be returning $1,000,000 above operating costs.

From the standpoint of silvicultural practice, I do not look for any very considerable changes in present practice in the yellow pine and larch-fir types. We will probably trend to more conservative cutting, with a shorter cutting cycle than we now figure on.

In the white pine type a considerable increase in the value of mixed species, making it possible to cut them on their own account without the white pine for a sweetener, would probably change our silvicultural methods considerably. I am convinced that the ideal method of cutting in mature white pine stands is a shelterwood cutting, which would take out everything except 10 to 30 selected dominant white pines to the acre. With all other species removed this would supply just about the proper degree of shade and a heavy supply of seed. As soon as the seedling crop was well established, which might be from 5 to 15 years, the shelterwood should be removed. The result would ordinarily be an even-aged stand consisting of 50 to 75 per cent white pine, which is about the ideal. This would mean two logging operations on each area. The ideal can not be reached until two things have happened—first, an increase in the value of hemlock, white fir, larch and Douglas fir logs of about $10 a thousand, and second, a permanent transportation system which will make it possible to come back for a second cut. The first requirement is out of our hands, and we can only wait for it. Perhaps it will not be as long as some of us think.

The second we are getting started, and it should progress as rapidly as is reasonably possible.

Transportation is the big thing to be developed on the National Forests. We will never, even in a hundred years, have such intricate systems of permanent minor roads as some of the European forests have, because the National Forests lie in big areas of rough mountain country far from the great concentrations of population, and will always be managed on a somewhat extensive scale. We must, however, have a permanent major transportation system of railroads and roads up all the larger stream valleys.

The railroads and some of the roads can be made to pay for themselves with current stumpage sales. Progressive timber sales will extend permanent logging railroads up all such streams as the North Fork of the Coeur d'Alene, the Little North Fork of the Coeur d'Alene, the North Fork and the South Fork of the Flathead, the Swan River, the Yaak River, the Bitterroot River, Fishhook Creek on the St. Joe, and Lightning Creek on the Pend Oreille. Such railroads can be built by purchasers of stumpage as a condition of the contract.

River driving will largely disappear except on a few good driving streams like the St. Joe River, where railroad construction would be very costly. Motor truck transportation for distances up to 10 or 12 miles is the transportation of the future. This will mean roads and more roads, a primary system of railroads up the main valleys and permanent surfaced roads up the side drainages. We have got to get away from the present plan of completely cleaning out a drainage of 100 million feet in 8 or 10 years and then leaving it alone for 100 years. Permanent roads will mean a much larger number of smaller operations, attacking the forest from many points instead of stripping each year large contiguous areas.

One of the main advantages to government construction of roads, rather than requiring them to be constructed by the purchaser of government timber as an obligation of the contract, is a less necessity for concentration of cut. Roads built by the operator involve selling and cutting large bodies of timber in a unit to immediately pay for the cost of the road. Roads built by the government permit gradual removal of timber in smaller quantities.

We are going to come to doing our own logging too, and when we do we will cut our forest units up into one-half to one-third of their present size, and each supervisor will be a logger and a road builder

and a forester, instead of a seller of stumpage and the head of a protective organization.

We will do lots more planting, too, and much more intensive silviculture. We have an obligation to fully reproduce all timber-sale areas when they are cut over and planting will be used extensively to supplement natural reproduction and fill up all fail spots in order to insure maximum production. We will concentrate on our really high-class productive soils, and make them produce the most wood possible, and more or less forget about the rough high country except for recreation and grazing. I only wish I could be on the job 40 or 50 years longer and see all this happen.

THE DECREASING IMPORTANCE OF FOREST GRAZING IN THE SOUTHERN APPALACHIAN REGION

By Ferdinand W. Haasis
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In 1925 a study was made by the Appalachian Forest Experiment Station of the importance in the southern Appalachian region of grazing on unfenced forest land. It is a matter of common observation that grazing and browsing animals cause damage to young trees where they have access to them. Whether such damage will be great enough to prevent the growth of a satisfactory new forest obviously depends upon the relation between the numbers of young trees and head of stock, the amount of other forage, the time the stock are on the area, and other such factors. Detailed studies of these relations have been made for other regions, but while there have been many observations of injury by grazing animals in the southern Appalachian region, no thorough study of the significance of this has yet been made here. The study of the importance of forest grazing in this region was made to determine whether or not the experiment station should at this time make an exhaustive study of such grazing damage to young forests.

The territory studied includes the Appalachian plateau, valley, and mountain parts of nine states, a total of 175 counties. The statements here made are based on reports covering 45 of these counties well distributed through the territory, as follows: 2 in Alabama, 5 in Georgia, 3 in Kentucky, 1 in Maryland, 9 in North Carolina, 1 in South Carolina, 10 in Tennessee, 12 in Virginia, and 2 in West Virginia. Most of these reports are from county agents, the rest from National Forest Supervisors, and other local men.

These reports indicate that, taking the region as a whole, forest grazing is not very important and is steadily decreasing in importance. Apparently there are four main reasons for this general steady decrease. In the first place, as the grade of stock becomes higher there is less forest grazing. High stock is too good for the open range. The owners want it where they can keep their eyes on it, both for protecting the stock and for maintaining and improving the grade.

The so-called "fence laws" are reducing the amount of range grazing. These laws make the stock owner liable for trespass and so result in his either keeping his stock in pastures or other fenced areas or getting rid of it.

Many of the stock owners are coming to the conclusion that pasture grazing produces better stock than forest grazing. Often where forest land is considered for grazing it is thought of as available after the timber has been cut and sometimes with the idea of artificial seeding to grass, in addition.

Lastly, low stock prices for the past few years, sometimes coupled with excessively high land values, have had a depressing effect on all stock raising. This factor is somewhat different from the other three. The grade of stock is all the time being improved. Fence laws are being extended every year to new territory. Pasture grazing will continue to be better than forest grazing, especially for the higher grades of stock which are being raised. But the market is subject to considerable changes both up and down for a number of reasons. Market conditions of the past few years are not a safe guide to what conditions will be for the next few years, and it is possible that better markets may at any time become significant enough to outweigh the other factors and bring forest grazing into importance throughout this region.

While the general situation in this region is as just stated, it is clear, from the few records of recent increases in forest grazing, that locally this practice may be of very great importance. Sometimes, too, there may be a great deal of very local damage due to the poor management of stock.

One form of poor management is poor distribution. Of our grazing animals, cattle, at least, tend to travel the coves and ridges, neglecting the slopes between. Better distribution can be gotten by well-planned salting. In case too many head of stock are put on an area they will eat nearly anything green before they will starve. Overstocking is relatively easy in the winter time. Then green plants are rare, and even such species as hemlock and holly are likely to be heavily browsed. But overstocking can happen in spring and summer, also. It is a question of the relation between the amount of forage on a given area and the number of head of stock grazed on that area.

The deductions from this study may be summarized as follows: taking the southern Appalachian region as a whole, forest grazing is not at present very important and is steadily decreasing in importance; though in a few localities it is even now of considerable importance and better markets may at any time bring it into importance throughout the region.

OUR MINE TIMBER SUPPLY IN PENNSYLVANIA AND OTHER COAL PRODUCING STATES *

By H. S. Newins
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The coal and timber industries represent two of the greatest resources bestowed by Nature upon the North American continent. Both have been exploited with reckless abandon of the fundamental principles of conservation because of the very lavishness with which Nature has seemed to bequeath these assets upon mankind. Coal is an expendable product which can not be reproduced by the arts and devices employed by man and yet this perishable resource has by its great bulk already survived the period of a plentiful supply of timber particularly in the vicinity of the coal producing mines. Today the coal industry is handicapped by the depletion of those necessary timber products which can so readily be reproduced by Nature under the guidance and protection of man.

Coal is produced from our mines annually at the average rate of 95,000,000 tons of anthracite and 540,000,000 tons of bituminous. Wood is required in enormous quantities to maintain this important industry. Props must be used in temporary openings to prevent the roof from settling, posts and cross-bars must be properly placed in the entries and the more permanent positions, and over these supports the necessary caps lagging or riprap are required. A great number of mine ties is necessary to support the underground car tracks. The rails themselves for these tracks are sometimes of wood and the cars and other necessary equipment consume in their construction great quantities of timber products. These various uses are so numerous and so large in the aggregate as to total .7 cubic feet for each ton of anthracite coal produced from the mines and .33 cubic feet for each ton of bituminous. No complicated calculation is required to reveal the tremendous drain necessitated by this industry upon our forests. And yet the cut-over and idle forest lands in the vicinity of all our coal producing mines are more than capable when placed under management of supplying these requirements indefinitely.

Coal Industry Uses Lumber Extensively

Statistics compiled by the United States Forest Service, Department of Agriculture, show that for the year 1905 the coal industry

* Read before the 39th annual meeting of the Coal Mining Institute of America at Pittsburgh, Pennsylvania, December 9-11, 1925.

absorbed for underground use 134,985,700 cubic feet of round timber and 242,000,000 board feet of sawed timber (see Table I). These exactions have continued and today the Department of Commerce announces that according to data collected in co-operation with the Departments of Agriculture and Interior 152,342,217 cubic feet of round timber and 296,641,000 board feet of sawed timber were used underground in 1923 by 5,205 coal mining establishments. This amount when converted by the factor of six board feet per cubic foot constitutes a grand total of 201,702,383 cubic feet, or reduced to cords by the equivalent of 80 cubic feet per cord (solid wood), a total of 2,522,279 cords. Based upon conservative figures of growth our unmanaged forests in the vicinity of coal mines should be capable of producing an average yearly growth of one-half cord of wood per acre. At this rate 5,044,558 acres of forest land, provided they were protected from fire, could be employed indefinitely to satisfy the present annual demands of the coal mining industry. But if these visionary forests were placed under intensive forest management it is not too much to expect an average production in growth of one cord per acre, thereby reducing the area by one-half.

It is obvious that the coal mines have consumed timber from available forests in much greater quantities than the forests can continue to produce under the destructive methods of the past. The forests of the nation have been drained so heavily to supply the requirements of general building and construction, planing mill products, and the needs of the combined wood using industries that today we as a nation are using annually four times as much timber as our forests are producing by growth. Our virgin timber has been exploited without regard to reproduction much the same as a spendthrift squanders his capital instead of being content with the interest which a careful investment may accrue to him annually.

Coal Mining Related to Forests

The coal mining industry is centered in the states of Pennsylvania, West Virginia and Illinois; and although some coal is produced in the Western states, the statement can be made that the bulk of the coal producing areas of today is located east of the Mississippi river. Virginia, Tennessee, Alabama, Kentucky and Indiana all produce coal in sufficient quantities to constitute an economic factor in the welfare of our national industries. These coal producing areas vary, of course, in their forest conditions but may all be classified together as to their

TABLE I

QUANTITY OF MINE TIMBER USED UNDERGROUND BY CLASSES OF MINES: 1923 and 1905[1]

Class of Mines	Number of Establishments [2]		Round Timber (Cubic Feet)		Sawed Timber (Board Feet)	
	1923	1905	1923	1905	1923	1905
Total	6,384	5,163	174,389,004	165,535,900	507,359,000	435,944,000
Bituminous	5,149	2,940	110,983,610	91,309,700	227,340,000	140,790,000
Anthracite	156	216	41,358,607	43,676,000	69,301,000	101,210,000
Iron	165	143	13,123,228	13,484,000	16,685,000	13,929,000
Other metal	879	1,718	8,780,092	15,282,500	193,333,000	164,956,000
Fire clay	35	.....	143,467	.....	700,000	.....
Miscellaneous	.....	146	.....	1,783,700	.....	15,059,000

TABLE II

QUANTITY OF MINE TIMBER USED UNDERGROUND BY STATES: 1923 and 1905[1]

State	Number of Establishments [2]		Round Timber (Cubic Feet)		Sawed Timber (Board Feet)	
	1923	1905	1923	1905	1923	1905
United States.	6,384	5,163	174,389,004	165,535,900	507,359,000	435,944,000
Pennsylvania	1,923	754	76,008,347	47,606,500	145,528,000	157,324,000
West Virginia	965	325	17,430,303	8,716,000	49,519,000	19,645,000
Illinois	344	400	14,964,030	10,342,300	15,045,000	7,025,000
Montana	126	153	4,416,894	4,008,400	61,817,000	62,852,000
Arizona	115	139	1,085,844	1,045,500	61,858,000	40,498,000
Ohio	530	(3)	6,045,014	(3)	23,341,000	(3)
Kentucky	410	(3)	6,534,541	(3)	20,989,000	(3)
Michigan	81	60	6,550,501	12,602,600	10,108,000	11,487,000
Minnesota	57	(3)	6,336,415	(3)	10,256,000	(3)
Colorado	227	487	5,404,933	4,340,900	6,743,000	13,518,000
All other states.	1,606	2,845	29,612,182	78,873,700	102,155,000	123,595,000

[1] Statistics for 1905 compiled by the Forest Service, Department of Agriculture.

[2] Reported as number of mines for 1905 and number of mining establishments for 1923. An establishment in some cases comprises a group of mines.

(3) Included in "All other states."

location in the heart of the great Central Hardwood Forest and their close vicinity to the Northern Forest where it claims its right-of-way southward along the Appalachian mountains through Pennsylvania, West Virginia, Virginia and Tennessee. Therefore in a very general way conditions as to available tree species and rate of growth are applicable to all.

Each of our large mining regions has ample forest land within the immediate vicinity to more than supply the requirements of the industry if these lands are placed under forest management. The 156 mining establishments reporting from the anthracite region actually own 500,000 acres of land and this alone placed under forest management would almost fulfill their requirements permanently. Yet this region is forced by the lack of sufficient local timber to import the bulk of the required stock, drawing these supplies chiefly from the loblolly pine districts of Virginia and Maryland, and even from Oregon via the Panama Canal and the Port of Philadelphia, and paying a price more than four times as great as that paid when the mine timbers were available locally. The average cost of mine timbers in 1905 was 6.6 cents per cubic foot. Today the average cost is 27.5 cents per cubic foot of round timber delivered, of which amount more than 57 per cent is for freight alone.

Local Supplies Near Exhaustion

In the bituminous regions of central and western Pennsylvania the supply of sawed timber has become well nigh exhausted and the mines are now importing from the South this material for use in main openings, car plank, and brattice. In fact, the city district of Pittsburgh uses alone more lumber annually than is produced each year in the entire state of Pennsylvania. Round timbers chiefly for props are available in sufficient quantities within the state but in many cases must be hauled a distance of some 200 or 300 miles and this material is fast disappearing. In the earlier days of coal mining this region was so well furnished with available timber that the valuable white pine was used. After the supply of this species was exhausted white oak, hemlock and chestnut were taken each in turn until today the industry must depend upon the second growth hardwoods for all temporary uses. Pine and hardwoods from the South are used for the more permanent type of construction as in entries, haulage ways, and main openings. However 75 per cent of all the wood products used in these mines is of round timber rather than sawed timber. Since these timbers are

employed in the smaller dimensions as well as in the larger sizes it is possible to utilize a great quantity of products from local forests for which there is no competition except in some cases where there may be a demand for post material. This region has sufficient forest land within its boundaries to easily supply the requirements of the mining industry. If these forest lands were placed under management a longer rotation would be necessary for sawed timber but the round timber of smaller size could be produced in the meanwhile in abundance and the cutting of the round timber largely as thinnings would benefit the forest.

Hardwood Supply Gives Way

West Virginia uses approximately 25,000,000 cubic feet of timber per year in the coal mines of the state. Until recently West Virginia ranked first in the total production of hardwoods in the United States, but now these valuable stands of hardwoods as well as those of pine and spruce are being rapidly exhausted by commercial exploitations, and already the mines of this woodland state are required to use an inferior grade of second growth timber.

Illinois ranks third in the consumption of wood for coal mining and used during 1921 an estimated total of 21,552,260 cubic feet as follows:

WOOD CONSUMED IN COAL-MINING IN ILLINOIS [4]

Class of Material	Pieces Number	Average Contents Cu. Ft.	Total Contents Cu. Ft.	Per Cent of Total Used	Per Cent Exclusive of Lumber
Props	16,115,640	.83	13,375,989	61.922	67.864
Mine Ties	3,844,850	.70	2,691,399	12.459	13.655
Caps	11,413,266	.16⅔	1,902,220	8.806	9.651
Legs and Bars	805,220	1.91	2,537,970	7.120	7.803
Riprap or lagging	.....	.....	202,422	.937	1.027
Total	.....	.....	19,710,000	91.244	100.00
		Total Bd. Ft.			
Mine Cars	36,600	7,978,800	1,329,800	6.320	
Construction	.....	3,074,760	512,460	2.436	
Total lumber	.....	11,053,560	1,842,260	8.756	
Total both classes	.....	.....	21,552,260	100.00	

[4] Second Report on a Forest Survey of Illinois. The Economics of Forestry in the State. By Herman H. Chapman and Robert B. Miller.

The more recent estimate for 1923 by the United States Department of Commerce shows a consumption of 17,471,530 cubic feet for underground use. On the basis of the year 1921 a total of 246,375 cords of wood is required to mine all the coal produced in Illinois.

Of all this wood 91.24[4] per cent is in the form of round or hewn products of which but 7.12 per cent are legs and bars of sizes large enough to yield lumber. Thus 84.12 per cent of all the wood used in these coal mines consists of relatively small props, mine ties and lagging which utilize trees down to three or four inches in diameter breast high. The average price paid at the mines for all classes of timber reduced to cubic feet was in 1921, 18.3 cents per cubic foot. The larger sizes such as for legs and bars cost 26.7 cents or an amount 46 per cent greater than the average while mine props cost 16.2 cents per cubic foot or 11.5 per cent lower. Therefore the larger sizes command a price per cubic foot 64.3 per cent greater than the smaller. It has been computed that an area of less than 500,000 acres of forest land will furnish a perpetual supply of mining timbers for Illinois. The mining companies own 799,000 acres, or 60 per cent more than they require to produce their own needs.

Much of Illinois Timber Home-Grown

Although known as the prairie state, Illinois continues to draw more than 60 per cent of the mine timber used from within its own boundaries. The introduced woods come most largely from the Ozark region of Missouri and are chiefly white and post oaks of small dimensions.

The Clinton district of Indiana uses mostly local timber of small sizes and these are of second growth and of inferior quality.

Kentucky produces annually about 29,500,000 tons and Tennessee about 7,000,000 tons of coal. On the estimated basis of .33 cubic feet per ton these states must consume jointly a total of approximately 12,000,000 cubic feet of timber. These states like West Virginia and Virginia are well supplied with valuable forest land and have already been large factors in supplying timbers to the coal mines of Pennsylvania. Hardwoods, chiefly oak and chestnut, constitute the principal species although spruce and pine were at one time abundant.

Virginia produces about 9,500,000 tons of coal annually and probably uses an amount of timber in excess of 3,000,000 cubic feet.

Alabama Has Variety of Woods

Alabama now produces about 15,000,000 tons of coal per year, and it is safe to assume that the annual requirement for timbers is almost 5,000,000 cubic feet for these coal mines alone. The Alabama forests have been pretty generally cut over but continue to yield longleaf, shortleaf, and loblolly pines, white oak, red oak, cypress, and red cedar among numerous other species not used in the mines.

The problem of timber shortage which confronts the coal mining industry may be solved in just two ways. The one which we have already referred to is that of scientific timber production, wherein cut-over and idle lands within the commercial vicinity of the mines may be put to work growing trees. Federal and state aid can well be expected in this enterprise but as a matter of sound economy the coal operators themselves should note the "handwriting on the wall" and take heed by focusing their foresight some 30 years in advance and organizing now their forestry departments and employing forest experts to supervise, manage and properly protect from fire the large holdings of timber land which they control.

Utilize Timber to Full Extent

The other solution is that of the closest utilization of every piece of timber which enters the mine. The excessive cost of substitutes and the mounting cost of wood itself requires that the mining engineer obtain the greatest possible value from all timbers used. Wood is essential because it is cheaper than substitutes, such as masonry and steel; it is easily worked and fitted to place and involves no great difficulty in handling. Moreover, the miners are entitled to a certain feeling of security when working among timbers of wood because if threatened by falling earth these timbers may sound the alarm by the crackling of the wood in advance of the actual danger.

To insure the greatest strength values in mine timbers the strongest pieces should be selected for the most important places, and especially is this true today when there is but little choice between good and bad local timber. Density is an important factor in this regard and is an indication of the amount of wood substance present, and considering two pieces of wood of equal moisture content the denser piece will have the greater strength. Defects such as decay, knots, shakes, splits, checks and cross grain seriously depreciate the strength values in wood, and where possible woods containing these defects

should be avoided. Wherever possible, timbers should be carefully seasoned before use. Timbers free from bark and properly air seasoned have greater strength and durability than those which are green and may harbor disease, insects and moisture beneath the bark. Careful inspection and selection at the mines in this respect should be an important factor in the closer utilization of our nation's rapidly dwindling timber supply. It is needless to plan increased production in our forests without first stopping the leakages which exist today in our utilization methods.

Fungus Causes Wood Decay

Decay in wood is caused by a disease we term "fungus." The fungus feeds upon food substances stored within the sap-wood cells, which food it obtains by the penetration of small threads called mycelium. Wood which is apparently sound may contain these tiny threads and will eventually succumb to decay. This fungus will thrive in the presence of air, moisture and warmth, all of which are required. Since light is no factor it may readily be understood why this disease develops to such an extent underground where it often presents itself to the miner in many grotesque forms adhering as fruiting bodies to the decaying wood. If the moisture content of wood can be reduced to a point lower than 20 per cent (based on dry weight) these fungi can not endure—hence the value of seasoning wood products to remove the fungus and thereby increase the durability of the wood. But, of course, seasoned wood placed in most mines will absorb moisture. Therefore, in these cases and where durability is required it is necessary to impregnate the wood with preservatives which are toxic against decay. The creosotes are more generally used for this purpose than the zinc chloride because the latter being soluble in water is subject to leaching.

Mine timbers are destroyed by decay, insects, fire and mechanical abrasion and of these, decay is by far the most destructive. Where the natural durability of the wood extends beyond the period of temporary use, it is not necessary to use preservative treatments. However, it is safe to presume that of all the timbers used underground for coal mining fully 15 per cent or 30,267,357 cubic feet are employed for the more permanent uses, such as in main entries, shafts and haulage ways. These timbers if untreated will in some cases barely endure one year of service, but assuming three years to be the average life there will then be required in the average mine shaft, tunnel drift

and gangway three renewals during a 12-year operating period and perhaps as many as five to ten. On the basis of the minimum number of renewals, there is used in our coal mines during a 12-year period for these more permanent uses a total of 121,069,428 cubic feet of timber, of which amount 90,802,071 cubic feet could have been saved by preservative treatment. At the average cost of 25 cents per cubic foot this amounts in value to $22,700,516.

Wood Preservation Necessary

Wood preservation has passed far beyond the experimental stage and is now a recognized necessity in the nation's scheme of closer utilization of wood products. Fortunately, some of our large mine operators have taken the initiative and are already setting the pace for others to follow. There is really nothing objectionable in the use of creosoted products in coal mines. Some miners have complained that the odor is objectionable, and they have expressed a fear of so-called explosive gases coming from the timber preservatives. This objection has no foundation of fact. Proper ventilation of mines is an important factor in the life of timber as well as it is a factor in the more important consideration of the life of the operating miner. A perfectly dry, well ventilated mine gives the longest life to timber, while a poorly ventilated mine which is alternately wet and dry gives the shortest life and a mine which is wet all the time but well ventilated rates between the two. Ample ventilation is essential to the prolonged life of mine timbers whether they be treated or untreated. Again we hear much of the fire hazard. Under any circumstances where the fire hazard is great as in downcast timbered shafts and shaft stations the timbers whether treated or untreated should be protected by a fireproof coating preferably of gunite, plaster, cement, concrete slabs, or other noninflammable substances.

The reclaiming of mine timbers or their salvage after temporary use would be an important utilization factor were it not for the hazard and cost involved in drawing the mine timbers from these working places. A post puller is on the market which partially eliminates this danger to the operator but on account of the cost of the operation the practice is generally considered prohibitive except in extreme cases.

Substitute Steel and Concrete

The present indications are such that in all probability steel and concrete will substitute wood in the more permanent locations in ad-

ditional amounts as time goes on. In coal mines where the waters are strongly acid, corrosive action tends to destroy these steel supports, but otherwise the conditions in these mines favor the use of substitutes as the cost of the large wood timbers advances. Brick and stone are sometimes used in constructing bulkheads or stoppings, but no satisfactory substitute for the wooden temporary roof support has as yet been found and since the aggregate of these temporary uses totals 85 per cent of the wood consumed underground it is important that conservation measures be undertaken to provide indefinitely these necessary timbers.

The Pennsylvania coal companies which have taken the initiative in practicing forestry upon their holdings include at least the following:

Clearfield Bituminous Coal Corporation, Indiana, Pennsylvania.
Lehigh Coal and Navigation Company, Lansford, Pennsylvania.
Berwind-White Coal Mining Company, Windber, Pennsylvania.
Philadelphia & Reading Coal & Iron Company, Pottsville, Pennsylvania.
Bethlehem Mines Corporation, Heilwood, Pennsylvania.
Rock Hill Coal & Coking Company, Hastings, Pennsylvania.
Rochester & Pittsburgh Coal & Iron Company, Indiana, Pennsylvania.
Cambria Mining & Manufacturing Company, Portage, Pennsylvania.
Eastern Bituminous Coal Mining Bonds, Frugality, Pennsylvania.
Homer City Coal Company, Johnstown, Pennsylvania.
Vinton Colliery Company, Vintondale, Pennsylvania.
Arrow Coal Mining Company, Pittsburgh, Pennsylvania.
Pittsburgh Coal Company, Pittsburgh, Pennsylvania.
Graceton Coal Company, Graceton, Pennsylvania.

Other companies are practicing forestry in a small way and it is hoped their influence may spread to the larger number of operators who have taken no action in this regard.

The Philadelphia & Reading Coal & Iron Company of the Anthracite region is now spending 30 cents per acre per annum for the protection and development of the forest land which their company controls. It has been estimated by Mr. A. C. Silvius, the forester of this company, that if 40 cents per acre were expended each year by each of the anthracite establishments it would take 33 years to expend for this purpose the equivalent of the present annual freight bill on wood timbers imported to this region. Mr. Silvius suggests that if the 500,000 acres of land controlled by these operators were divided into units of 5,000 acres or more, the expenditure of 40 cents per acre might well be made as follows:

For roads, trails and fire lanes	15c per acre
For surveys and maps	2c per acre
For forest planting	4c per acre
For fire prevention	4c per acre
For fire extinction	2c per acre
For tools and supplies	1c per acre
For supervision	5c per acre
For miscellaneous expenses	2c per acre
For slash disposal	5c per acre
Total	40c per acre

The Clearfield Bituminous Coal Corporation offers an excellent illustration of what may be achieved in the bituminous regions when the responsible parties are thoroughly aroused to the forestry situation. The forestry branch of this company was first organized in the spring of 1920. The company's holdings comprise 150,000 acres, of which 24,000 acres are owned in fee and are available for reforestation. A survey of this land indicates that 2,000 acres are covered with a good stand of timber, 16,000 acres contain natural reproduction, 4,000 acres are barren, 1,000 acres are semi-barren near the mines, and 1,000 acres are of farm land. Since 1920 rapid strides have been made in the proper care of this forest land. The natural reproduction has been encouraged in its growth, fire lanes have been cut, roads opened, and a fire tower connecting by telephone with the state system has been erected. But the biggest development has been this company's forest tree nursery. The nursery site was established in September, 1923, near the town of Clymer, Indiana County, Pennsylvania, and the first seed were sown in March, 1924. An inventory taken in August, 1925, showed for this nursery about 2,215,000 two-year-old coniferous seedlings and 2,140,000 one-year-old coniferous seedlings. In addition the nursery contains about 16,000 hardwood seedlings and 170,000 transplants. This nursery is the largest and most successfully operated of any forest tree nursery controlled privately in Pennsylvania. This company is contemplating the planting of 1,000,000 trees each year.

Planting Forest Trees Reduces Tax

The planting of forest trees upon idle land not only improves the value of the property but also reduces the tax bill of the property owner appreciably. The state of Pennsylvania provides for placing such

improved forest lands in a class called the auxiliary forest reserve and assesses each acre at a sum not to exceed one dollar until the time when the protected timber is ready to cut and then the state claims one-tenth of the stumpage value of the products. This affords one of the best arguments in favor of forestry on coal lands and is really too good a business proposition to pass unaccepted.

Perhaps the coal operators of some thirty years ago may be excused for their apparent lack of forest conservation, but today the issue is squarely before us and we can not side-step the responsibility. The necessary information for the application of forestry to the coal lands is free for the asking. The United States Forest Service, and the various state forestry organizations are prepared to "lend a hand."

The Forest Extension Service of the Pennsylvania State College will respond promptly when called upon for any assistance of this nature in the state of Pennsylvania.

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METHODS OF READING MULTIPLE QUANTITIES FROM CURVES

By W. H. Meyer
Northeastern Forest Experiment Station, U. S. Forest Service

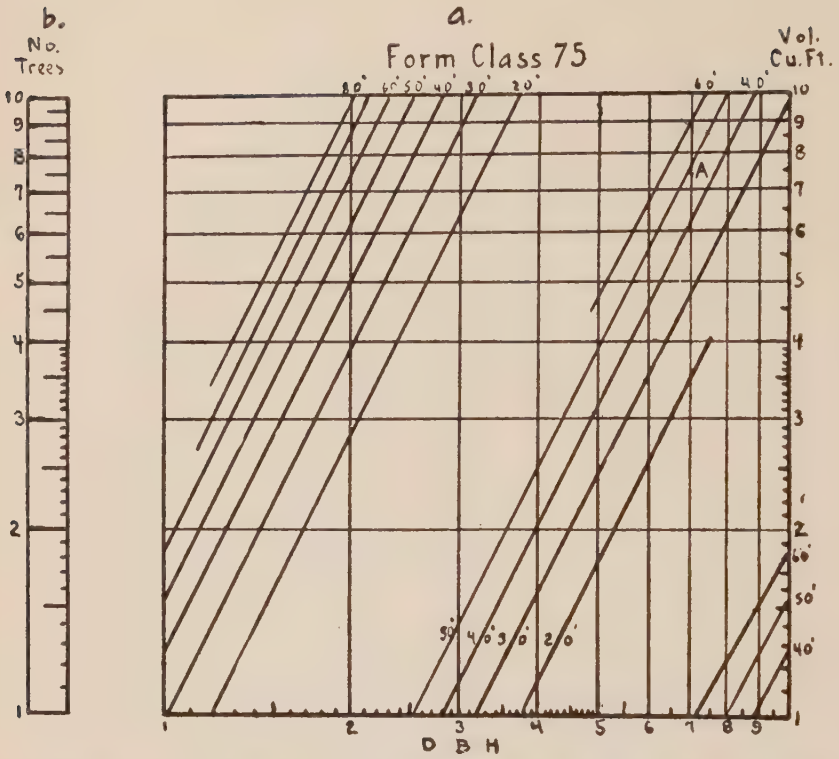
Any set of computations which involves the reading of a single value from a table or set of curves and the multiplication of this single value entails much mental computation and the use of the slide rule, which can be easily avoided by several graphical methods. Especially valuable are such short cut methods when the amount of data obtained is large, such as a collection of tally sheets from a strip survey or a series of plots in a yield study, for which, at least with the latter group of material, it is desirable to interpolate to the nearest foot in height when volumes are concerned. The following methods are proposed to relieve this necessity of interpolation from a table to obtain a single value, for example, the total cubic foot volume of a 7-inch tree, 48 feet high, and then of multiplying this amount by the quantity occurring in the particular group, such as in the above case, twenty-four 7-inch trees, 48 feet high.

In a current yield study of second-growth red spruce a large number of plot volumes had to be calculated in cubic feet and board feet. The usual tedious methods were first made use of with a consequent realization that much labor as well as mental strain could be saved if methods were evolved to eliminate several of the stages. Two ways based on old principles, which are possibly used in other lines of work besides forestry, were found by which this saving could be effected.

Figure Ia presents a set of total cubic foot volume curves based upon the form class system of volumes. The scale used is the double logarithmetic scale. As cubic foot volumes of trees of the same height and form class vary with the squares of their diameters, straight lines for the volume curves are to be expected when plotted on double logarithmic paper. However, this straightness is not at all necessary in the application of the methods to be presented, and can not be obtained with all tables. Ocular interpolation is just as easily made whether curvature is present or absent.

For the sake of those not familiar with logarithmic paper a few words may be helpful. First of all, the diagram shown has only the major divisions, while in actual practice the lines are plotted on a much larger scale with much finer divisions, such as a 10x10 sheet of one-

Figure I



cycle logarithmic paper. The numerals along the base represent diameters, starting at the left from 1 inch, running up to 10 inches at the right, and starting over again with 10 at the left and going up to 100. The upright axis represents volumes starting similarly with .1 ranging to 1 at the upper end, back to the base with 1 ranging to 10, etc., as may be necessary. Knowledge of placing the decimal point is obtained by comparison with compiled tables and by actual practice. For example, a tree 40 feet high, normal diameter 5 inches, has a volume of 3.3 cubic feet; a tree 50 feet high, normal diameter 20 inches, contains 62 cubic feet; while a tree 20 feet high, normal diameter 2 inches, contains .28 cubic feet. A single height curve, such as 50, starts in this instance at a point 2.5 at the base, runs diagonally to 8.0 at the top; restarts at 8.0 on the bottom and runs out at 1.55 on the right side, is resumed at 1.55 on the left, and runs out at 2.5 at the top. This is not as confusing as may seem at the first glance.

A scale (Figure Ib) with the same logarithmic divisions as the scale of the drawing is next necessary. Now multiples of volumes can be secured. To illustrate specifically at first, let the original example of 24 trees 48 feet high, with the normal diameter of 7 inches, be taken. First, 7 inches is picked out at the base; then 48 feet between curves 40 and 50 is interpolated by eye (point A). In practice, the five foot lines are also drawn in to facilitate this ocular interpolation. It is not necessary to read this value. The next step is to bring either end of the scale to this point, in this case the upper end, with its edge along the 7-inch line. At point 24 of this imposed scale, read off from the diagram the cubic foot volume which will be the volume of 24 trees 48 feet high, normal diameter 7 inches, or 178 cubic feet. In general terms, the procedure is: (1) obtain the desired volume point on the system of coordinate; (2) translate one end of the logarithmic scale to this point with its edge coinciding with the inch class; (3) read off desired multiple value on the diagram at the point of the scale corresponding to the number of trees. It must be continually borne in mind with the present illustration that in actual practice much finer divisions are used, which enable a close reading, such as in the case of 178.

If the style of logarithmic paper suggested is used, that is 1-cycle, 10x10 logarithmic, the graduations will be found to conform with those of an ordinary 10-inch slide rule. This means that the sliding portions of the rule may be used for a scale; or, also, that the slide rule as a whole could be used by simply placing it down on the graph at the proper ordinate, then shifting the slide to a point opposite the single reading, and finally obtaining a multiple volume in the usual method of slide rule manipulation.

The principle of this is not only applicable to volume tables, but to any set of curves, whether they form straight lines or not on logarithmic paper. The theory underlying this procedure is, of course, the same as that for the slide rule.

Figure IIa presents a second short-cut method, which may in certain cases be more desirable than the above, but on the whole is a trifle more time-consuming. Ordinary graph paper is used this time. Only a portion of the same set of curves as used in Figure Ia will be plotted this time, using again as in the previous case only a few divisions of the axes, which in practice would be finely subdivided. The additional scale in this case (Figure IIb) takes the form of an alignment chart, in which the divisions of the two parallel axes, that is the axes of the multiplicand and the product, have equal divisions with that of the

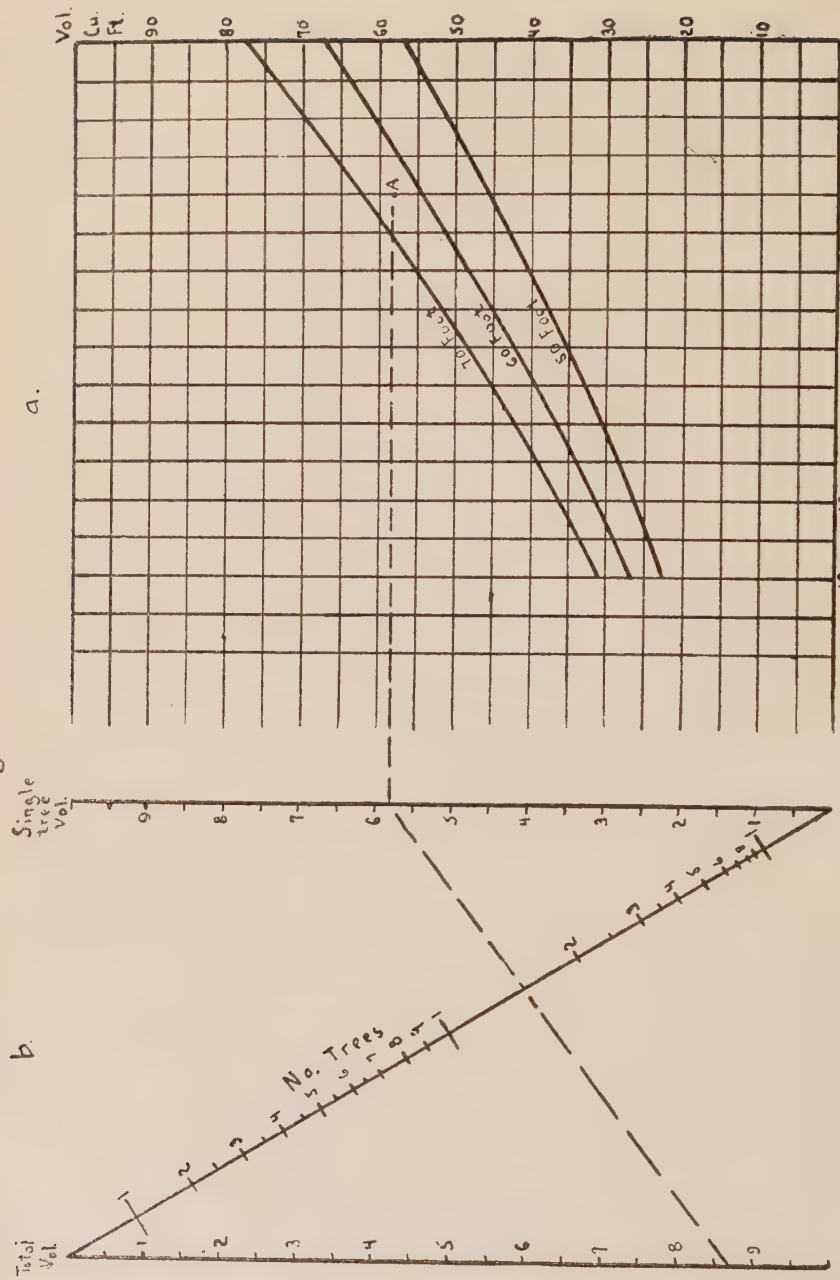

a.
Vol. Cu. Ft.
90
80
70
60
50
40
30
20
10
12
13
14
15
16
17
18
D.B.H.
A
300 Bd. Ft. Vol.
200 Bd. Ft. Vol.
100 Bd. Ft. Vol.
b.
Single tree Vol.
No. Trees
Total Vol.

Figure II

chart. The directions of the divisions are opposite, however, because the one on the right (the muliplicand) starts at the bottom as does the volume graph, while the one at the left (the product) starts at the top. The multiplier is located on a diagonal line connecting these two origins. The graduations on this diagonal are marked off by actually spanning the space between the two parallels (product on left, multiplicand on right), and getting intersections (multipliers) on the diagonal. For instance, 8 on the right-hand scale and 32 on the left-hand scale would place the division 4 on the diagonal. This checks with other combinations, as will be seen by spanning 6 and 24, which also gives 4. In the same way the whole diagonal is graduated. As is the case in Figure I, the amounts here also represent varying values since, for example, 4 on the diagonal may also be 40. The product, of course, is correspondingly changed.

To proceed with a specific example illustrating the use of the charts, let the volume of 15 trees 65 feet high, normal diameter 17 inches, be found. First, height 65 on 17 inches is ocularly interpolated, resulting in point A. The value need not be read. For the next step, the alignment chart is shifted so that the right-hand edge coincides with the 17-inch upright, and its base with the base of the graph; that is, equal divisions of alignment chart and graph will coincide. From Point A, now in contact with the right-hand scale of the nomograph, span with a straight edge 15 on the diagonal, which in turn gives the product of 870 on the left-hand, upright scale. In general terms, this can be stated: (1) determine position of desired volume on the graph by ocular interpolation; (2) move alignment chart so that its right-hand edge coincides with the desired diameter and its base with the base of the graph; (3) with a straight edge, span the point of single volume on the right-hand scale, and the multiplier, or quantity of trees, on the diagonal; (4) read off the product on the left-hand scale, placing the decimal point properly.

Again, as in the previous method, the principle can be applied to other sets of curves. In addition, the one alignment chart can be used for any graph on paper of the same divisions. Should the divisions of the graph have other values, which as a rule are multiples of the divisions here shown, these can be placed on the alignment chart in a similar fashion, giving both right- and left-hand scales equal graduations, but oppositely directed. The origin of the chart and the base of the graph should, however, both be zero, if it is desired to retain the same divisions on the diagonal.

A METHOD OF MEASURING FORM QUOTIENT OF STANDING TREES

By Francis X. Schumacher
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A knowledge of form quotients of stand and species is of more interest to foresters since Jonson published his volume tables based on diameter, height, and form class.[1] In order to use the proper table, since form is a variable, it is necessary to know the average form class or form quotient of a given stand.

The form point method for finding average form class, as proposed by Jonson, and used in Sweden, has not been found universally

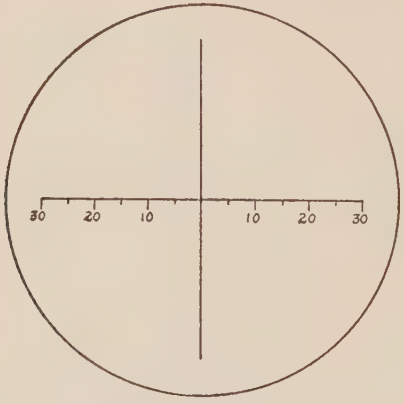


Figure 1. Reticule graduations, field glass type EE.

satisfactory in Canada[2] where his tables have also been used. Form point is the height to the center of gravity of a tree's crown, and tables have been prepared for converting form point to form class.

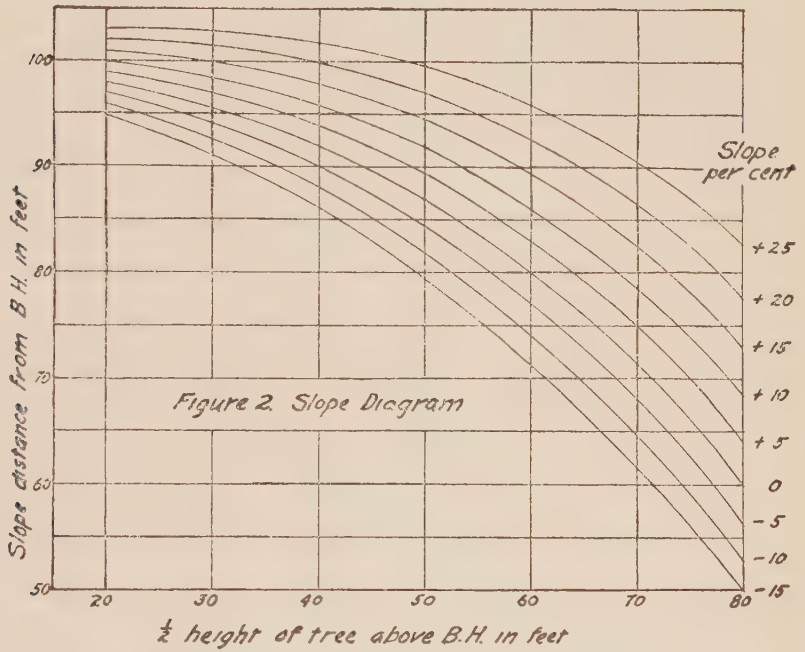
It seems that form quotient should be computed by measuring the diameter at half the height of a tree with a dendrometer. Certainly this is most direct, other than felling and measuring, or using tree climbers. But dendrometers have been unsatisfactory instru-

[1]Jonson, Tor. Massatabeller för Träduppskattning, 1915. Stockholm, Zetterlund & Thelanders Boktryckeri-Aktiebolag.

[2]Wright, W. G. Investigation of Taper as a Factor in Measurement of Standing Timber. Journal of Forestry, 21:569-581. 1923.

ments, because either they are too delicate for woods work, or they require the steadiness of a tripod, hence are cumbersome.

The writer has used an instrument as a dendrometer that has neither of the disadvantages named. It is the U. S. Army Signal Corps type EE field glass, with mil scale. The mil scale, which makes the glass applicable, consists of equally spaced horizontal graduations,



etched upon a glass reticule. (Figure 1.) This is fitted in the left telescope of the instrument. In using, the intersection of vertical and horizontal lines is pointed at one side of the tree's bole, and the other side cuts the horizontal scale. The diameter is read in mils. Many foresters, doubtless, have used this field glass in army days.

The principle involved, of similar triangles, is not new in dendrometers. However, the writer knows of no hand dendrometer fitted with a telescope.

Through the six power glass the tree's bole becomes, apparently, correspondingly nearer to the observer's eye, making accurate readings possible, although when held free the object appears somewhat unsteady.

Even so, an average of readings is reliable. If the glass is rested on any handy staff stuck into the ground, one reading is sufficient for each measurement.

In a dendrometer of this type, the distance from observer to the B.H. and the upper point of a tree's bole must be known, or equidistant, in order to establish relationship between the two diameters. It is simpler to make the two distances equal. Figure 2 illustrates this for distances of 100 feet. It shows at what distance the observer's eye must be from the B.H. point of a tree, for different per cent slopes and tree heights, in order to be 100 feet from the point half the height above B.H. Slopes are shown in per cent rather than in degrees, because standard hypsometers are graduated in per cent.

If normal form class is wanted inside bark and corrected for root swelling converting tables are necessary. But would not such tables, based on actual absolute form quotients of a group of trees, be a more reliable index to normal form than tables based on form point?

FOREST FIRES AND WEATHER

By A. E. Moss
Connecticut Agricultural College

Connecticut is within the northern extension of the southern hardwoods. Only a very few small areas of pure coniferous growth occur on the eastern and northern boundaries. The fire problem is, therefore, one of controlling surface fires in hardwood litter. The rainfall is very evenly distributed with an average of about 45 inches per year. There is, however, a very definite fire season following the winter snow and before the ground is shaded by the new growth. The fire system in Connecticut calls for all fires to be reported by days, and records show that the fires of March, April and May amount to over 80 per cent of the total for the year, with the larger per cent occurring between March 15th and May 15th.

Studies have been made and are being made as to the effect of weather conditions on the fire hazard in coniferous stands. The duff tends to be deeper, lies closer to the ground and, having a greater layer of humus, it retains moisture to a greater extent than hardwood litter. The moisture content of the forest floor in a sprout hardwood forest apparently fluctuates much more consistently with slight changes in weather conditions. The lack of shade before leaves are developed, excessive air circulation, and looseness of litter reduces its moisture retaining capacity to a great extent and permits of rapid loss of rain water.

The following is an attempt to correlate the frequency and area of fires with the records of the weather for the same days. The relation of fires to precipitation was not as constant as the relation of fires to humidity, high humidity without any precipitation having nearly as great an effect as high humidity with precipitation. The effect of humidity of the current day did not have as great an effect on fires as that of the preceding day, averaged with the current day. Temperature did not have as much effect as humidity or precipitation, for low humidity in this region may be taken as an indication of relatively high temperature. The temperature factor, therefore, may be eliminated. Readings at 8 A. M. seemed to be as consistent as those of 12 noon. Sixty per cent at 8 o'clock approximately equalled 45 per cent at noon, and therefore were used, as it would enable plans being made for increased protection during the period of fire danger.

The two graphs are for the years 1922, 1923 and 1924, showing frequency of fires, based on a two-day moving average of relative humidity taken at 8 A. M., and the total area burned for the same period and based on the same humidity readings.

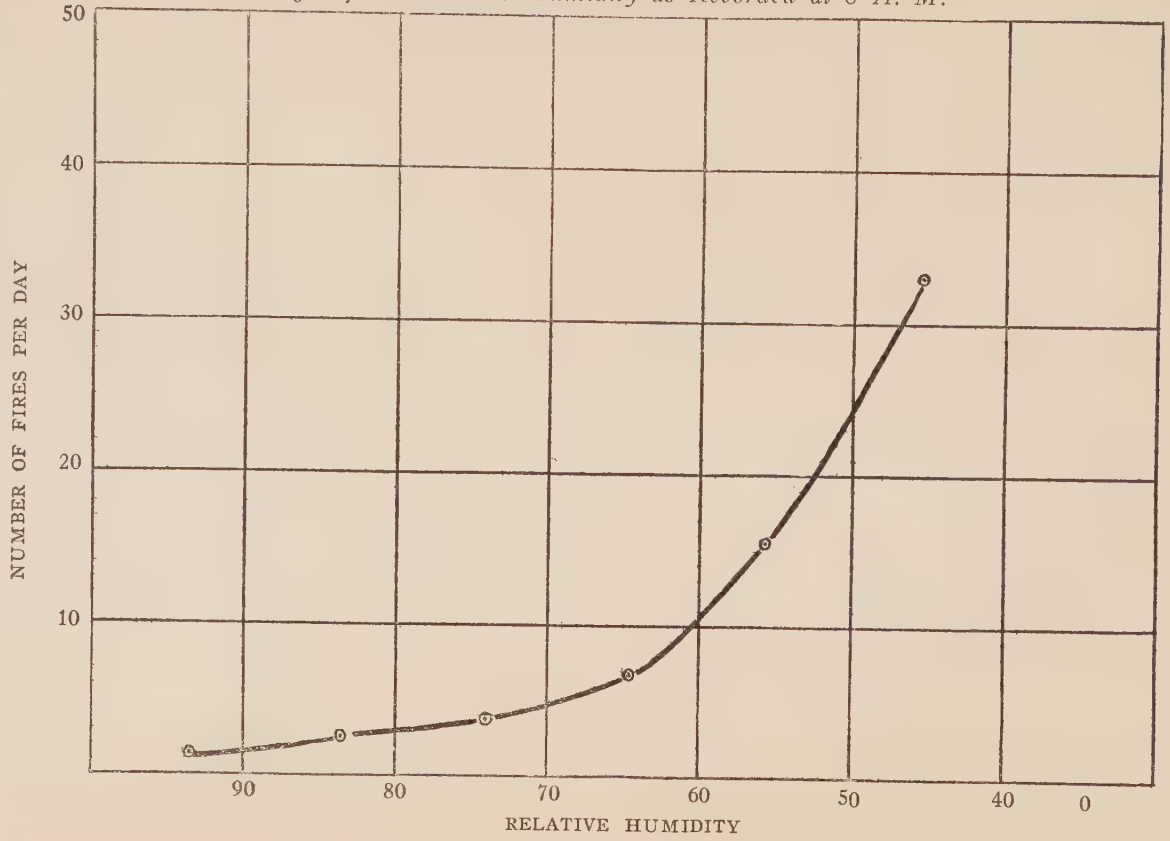
It may be assumed that the average elapsed time from reporting a fire until a crew begins suppression is fairly constant. The size of the median fire for a given humidity should, therefore, indicate the relative rapidity of spread at a given fire risk. A median table of fires based on humidity was prepared, in which the area of a fire burning more than one day was proportioned over the entire period of the fire.

MEDIAN FIRE

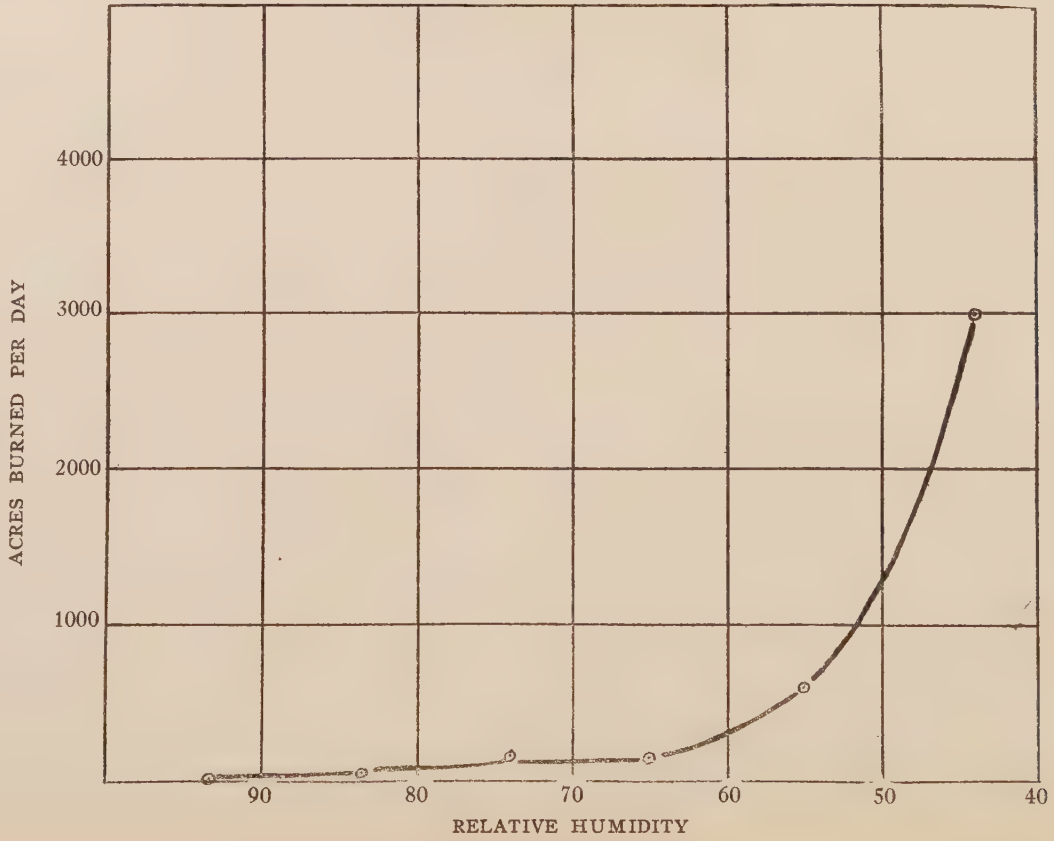
Humidity	Area
90	3
80	5
70	7
60	10
50	15
45	20

Conclusions then may be drawn that the danger point for Connecticut is when the relative humidity at 8 a. m. for two days averages less than 60 per cent. All fire permits should be suspended and extra patrol measures should be adopted until the relative humidity rises above the danger point.

Number of Fires Per Day, March 15 to May 15, for the Years 1922, 1923, 1924, Based on a Two-Day Moving Average of the Relative Humidity as Recorded at 8 A. M.



Acres Burned Per Day, March 15 to May 15, for the Years 1922, 1923, 1924, Based on a Two-Day Moving Average of the Relative Humidity as Recorded at 8 A. M.



STATE FORESTS IN NEW ENGLAND*

By W. A. L. Bazeley
Commissioner Mass. Dept. of Conservation

The state forestry movement started early in New England, the first technical State Forester being appointed in Connecticut in 1902 while New Hampshire had an unpaid and unsupported Forestry Commission dating back to 1893. The movement for the acquisition of public forests, however, was slow to get under way and it is only in the past five years that it has attained any measureable headway. Even now this movement often gets bogged in the mire of public economy. It is true that Connecticut holds the honor of making one or two small purchases for state forests in that ancient period of American forest history back in 1903 and New Hampshire acquired by gift Mt. Monadnock in 1905, but after these feeble beginnings the idea of state forests seems to have languished not to reappear again for almost ten years. Massachusetts started the purchase of lands for forestry purposes in 1908 under the terms of the reforestation act which gave to the original owner the right to repurchase these lands at any time within ten years by repaying the cost of the land plus the amount expended for reforestation or other improvements. Of course while this ten year option remained on these lands they could not be considered as permanent state property, so that none of this land came into the category of "state forest" until after 1918. Of the 6,000 acres acquired under this act about 2,000 have been redeemed by the former owners, 2,000 acres have become permanent state property and the remaining 2,000 acres still have outstanding options.

But to return to the state forest movement, Vermont seems to have been the next state to make a beginning when it received its first state forest as a gift in 1909 and acquired several others by purchase in the next two or three years. New Hampshire took up the idea in 1912 by enacting a law making it possible to purchase lands for state forests. Previously New Hampshire had received four tracts of land for state forest purposes as gifts. The first land to be bought under the new act was the Crawford Notch Forest of 6,000 acres.

In 1914 Massachusetts started on a program of state forest acquisition by creating a State Forest Commission consisting of the State Forester and two other men, who were given an appropriation of $90,000 to be spent over a period of five years in the purchase of lands for

*Read at Second New England Forestry Congress, Springfield, Mass., Dec. 11, 1925.

state forests. The outbreak of the World War interrupted the program of this commission, but during its lifetime of five years it purchased five forests with a total area of 13,000 acres. With the re-organization of the state departments in 1919, this commission was abolished and its powers transferred to the Commissioner of Conservation. In 1920, largely through the efforts and influence of the Massachusetts Forestry Association, a new state forest act was passed whereby the Department of Conservation was authorized to buy 100,000 acres of state forests during a period of 15 years and to expend the sum of $3,000,000 in the purchase and development of this area. To date under this new act, Massachusetts has acquired 85,000 acres divided into 35 state forests.

The year 1925 has added another important chapter to the state forest movement in New England. Connecticut has established by law a Forestry and Wild Life Commission made up of members of the forestry and game commissions of that state and given to it an appropriation of $75,000 per year to acquire wild lands for forest production and game propagation. It is estimated that this act will add 25,000 acres to Connecticut's 12,000 acres of state forests in the next biennium. New Hampshire from its comparatively meagre resources has voted to spend $200,000 in the acquisition of the famous Franconia Notch including the "Old Man of the Mountain" and several thousand more acres will soon be added to her state forests.

The foregoing is a brief historical sketch of the movement for the acquisition of state forests in this section of the United States. Slow in starting it has gradually gathered momentum and we hope that soon the great forest state of Maine will climb on the band wagon and little Rhode Island, too, will do her bit. It seems that a modest ideal calls for the ownership by the states of 10 per cent of the forest land within their borders. There are 20,000,000 acres of forest lands in New England and this means an ownership by the states of more than 2,000,000 acres. In New Hampshire where the federal government owns large tracts and in Maine or Vermont where it may acquire more, this 10 per cent quota can be reduced.

Let us see where we stand at the present time.

STATE FORESTS

State	No.	Area	Trees Planted	Purchase	Maintenance
New Hampshire	47	20,000	1,000,000	$ 5,000	*
Vermont	15	31,000	2,000,000	2,000	$ 9,000
Connecticut	8	16,000	1,000,000	75,000†	15,000
Massachusetts	40	100,000	6,000,000	75,000	75,000
Totals	110	167,000	10,000,000	$157,000	$100,000

* Uses small sums from other appropriations.
† Act of 1925. Previous appropriations were $10,000 annually.

It is evident, therefore, that the amount of state forest land here in New England should be from 5 to 10 times what it is at present.

While on the subject of "state forests" it seems well to say a word about "state parks." It is very hard to draw a hard and fast line between the two, but generally speaking a forest park is land which includes some outstanding region or object of scenic beauty and a place where the protection of the surrounding forests is essential to the preservation of the beauty of that area. If any timber can be produced in a "park" it is incidental. On the other hand "state forests" are established for the production of timber and preservation of scenery is more or less secondary. It often happens that there are certain portions of state forests which are more valuable for recreational use or for scenic protection than for timber raising, but it is always possible to set aside such places and maintain them for recreational purposes. The State Forester must, however, resist the pressure from people who because of their love for the great outdoors wish to see every bit of public wild land made into a park and leave nothing for economic use.

Massachusetts and Connecticut are the only New England states with an organized system of state parks. Connecticut has 25 state parks with an area of 5,000 acres. Together with her state forests they are under the jurisdiction of the Park and Forest Commission but the parks and the forests are under separate administration. Such a system seems to be a most ingenious way of combining the two ideas in one department, yet separating them sufficiently to avoid duplication on one hand and friction on the other. Massachusetts has seven state parks with an area of 12,000 acres. While these "state reservations" as they are called are owned by the state, they are managed and maintained by the county in which they are located. Such a system works very well if the county authorities are interested in their parks, but very poorly if they are not, and results in an unsystematic and irregular policy of development, both of the recreational and forestry features of these reservations when they are considered as a whole.

The state forest movement in New England is still in its infantile stage. Although he is quite a lusty infant he still requires the nursing bottle of public interest and support and he must, of course, have the care and consideration of those who are vitally interested in making New England into a self-supporting forest region, if he is to reach that self-reliant manhood which we hope that he will some day attain.

FORESTRY IN BRITISH HONDURAS

By Samuel J. Record
Yale University

British Honduras, after living off her forests for upward of three centuries, has at last come to the realization that they are in need of some expert attention. Nature in the Tropics seems particularly eager to heal any wounds made in the jungle by logging or cultivation, but to her a tree is a tree, and mahogany a mere incident. To the inhabitants of the Colony, mahogany means meat and drink, and a future without a plentiful supply of that timber is unthinkable.

In most countries agriculture or fruit growing or mining is the ultimate goal, and the forests are eventually restricted to poorly accessible areas and lands for which no other use has been found. In British Honduras, agriculture and horticulture and mining are in their infancy, or possibly their dotage. The banana industry thrived for a brief space, but fell a prey to the "Panama disease." The farming methods pursued by the natives are, for the most part, exceedingly primitive—cutting deeper and deeper into the high forest and letting the jungle of mostly useless species follow only two years behind. These "milpah" cutters, as they are called, will tell you that the "sile gets tired" after two crops, but the outsider wonders if the fatigue is the soil's!

The Colony has by no means exhausted its agricultural possibilities, in fact it appears scarcely to have touched them. But the people are not agriculturalists and do not think in terms of farming and fruit-growing. In the local government there is no agricultural department, no one to give his entire time and attention to this important field. The Colonial Secretary is alive to such needs, but the multiplicity of his duties limits his activities in this direction.

The people in general think in terms of timber, and timber is now almost synonymous with mahogany. From the time of its earliest settlement the only important source of revenue has been the forest. According to some accounts the first Europeans were buccaneers who, in time, abandoned piracy on the high seas for the more prosaic, though perhaps fully as profitable, business of cutting logwood. Others refer to these early comers as "shipwrecked mariners and adventurers," most of the latter coming from Jamaica. At any rate, by 1662 there was a regular establishment of logwood cutters in Belize and in 1671 the

governor of Jamaica reported to the King that the new settlement "increased His Majesty's customs and the national commerce more than any of His Majesty's colonies." This situation is readily understood when it is realized that logwood was a staple commodity selling at a price equivalent to more than $1,000 a ton at present money values.

In addition to logwood, the forests contained large quantities of splendid mahogany and Spanish cedar trees readily accessible from the rivers. Such trees supplied the settlers with dugout canoes, ship timbers, and construction material, and eventually entered the export trade. Shipments were commonly made by way of Jamaica and much of the Jamaican mahogany on the English market had its origin in British Honduras. Gradually, with the introduction of aniline dyes, the logwood market declined and mahogany became the mainstay of the Colony, and so remains. The cutting of logwood continues, a mere remnant of its former importance. The oddly shaped billets no longer yield their dye for the production of woaded black broadcloth, the emblem of respectability, but impart a ruby redness to French wines instead!

Of a total area of about 5½ million acres, there are approximately four million acres of forest land in British Honduras. Of the latter amount, about 2½ million acres are workable high forest, containing mahogany, and 1½ million acres practically pure pine forest. The remainder is occupied by swamps, lagoons, rivers, inaccessible hill areas, and cultivated lands.

The present annual toll of mahogany is about ten million board feet, valued at about one million dollars. The total value of all forest produce exported last year was $1,269,488; agricultural produce, $298,-440; marine produce, $40,070; grand total, $1,607,998. Thus, of the things which the Colony has to sell, about 80 per cent (in 1924 it was 83 per cent) is produced directly by her forests. The continued prosperity of the people depends upon the continued productivity of the forests.

In considering the fact that these same forests have gone on producing mahogany for two hundred years it might appear that they were inexhaustible and that nature unaided could be depended upon to replace the trees as they are removed. This is the dangerous belief publicly expressed by a small, but all too influential, coterie of people who "view with alarm" any expenditure of public funds for the introduction of scientific forestry methods. Sincerely or otherwise, they claim that mahogany will grow only where the soil is exactly to its

liking and that any attempt to get it to grow elsewhere is useless. When it is considered that an average of one mahogany tree per acre in the natural forest is considered an excellent stand and that over large areas of merchantable timberland the average is only one tree to from two to five acres, it seems absurd to believe that all of the available spots for growing mahogany trees are exhausted. And when it is further considered that formerly large mahogany trees could be cut at the water's edge, where now it is necessary to go back ten or fifteen miles into the interior to find a merchantable tree, it is obvious that the efforts of nature are being overtaxed.

Moreover, conditions are rapidly changing. In former days only big trees were cut, the smaller sizes being left to grow. Increasing scarcity of the larger sizes has given a value to the smaller, so that little remains on private holdings after the present day operator has passed. There is nothing novel or unique about this situation; on the contrary, it is but a repetition of what occurs in every country as the virgin forests are culled and re-culled of their more valuable kinds of timber. The lowering of the standards of size and quality carries a plain warning,—all too generally ignored.

Another important factor in the situation is the introduction of tractors to replace ox teams. It is estimated that there are now about 300 tractors being used in extracting logs and transporting supplies for the logging camps. The logs are hauled on trucks during the dry season and deposited along the banks of the streams to await the floods which carry them down to the coast. Tractors increase the practical hauling distance two or three times over that feasible with oxen. This opening up of previously inaccessible timber has increased the output and tends to conceal the fact that the Colony is feeding on the last reserves of its timber capital. The building of logging railroads and overhead cables by some of the larger companies is also hastening the process of timber depletion.

The fact that British Honduras has as much timber left as she has is not due to any constructive policy on her part, but rather to a lack of transportation facilities other than those supplied by her streams. With a total population of only 45,000—men, women and children—most of whom never get outside of the towns, with almost no year-round roads and a scarcity of material for their construction, progress has necessarily been slow and one would never guess from looking at the country that it had been under European control for nearly 300 years.

Those familiar with the forest situation have realized for several years that all was not well and that "something ought to be done about it." It remained for Mr. C. Hummel, a British Forester of Austrian lineage, to go into the situation carefully and devise a plan of action. This was done at the instance of the Colonial Research Committee. The wisdom of this investigator's findings was recognized by the Government officials and they proceeded to put his recommendations into effect with commendable promptness. A Forestry Department was created and on April 1, 1922, Mr. Hummel was appointed Conservator of Forests. By an ordinance dated August 15, 1923, responsibility for the development and maintenance of the Crown forests of the Colony, and for the administration of funds provided for that purpose, was invested in a Forest Trust, consisting of two official and two non-official members under the chairmanship of the Governor. A second ordinance, enacted simultaneously, provided for a loan of $250,000 to supplement such contributions from general revenue as might be possible to devote to forest development. It was later agreed that the latter contribution should be determined as a percentage of the actual forest revenue, beginning with 30 per cent for the year 1924-25 and increasing 10 per cent annually until 60 per cent had been reached.

The Forest Trust is a unique organization which tends to assure permanence and a freedom from petty politics. A forestry department organized and administered in the usual way, without any assurance of funds from one year to the next, would have been weak and ineffectual. Forestry is the concern of the whole Colony and involves present sacrifice for future well-being, and it is hard for some of the Belize merchants to realize that the need for such sacrifice should come in their day.

The loudest fulminations against the Forest Trust are contained in a negro newspaper, The Independent, whose editor seems to consider such government activity a menace to his race. Any issue of that sheet is counted lost which does not contain a fling at the bearer of the white man's burden in general, and of the Forest Trust in particular. On January 6, 1926, the following bouquet was tendered under the title of, "Lights and Shadows: 1. The Forestry Department. 2. Liberty or Death. 3. God and Abd-el-krim. 4. Traitors Again. 5. Xmas Greetings.

"The frank discussion on the Forestry Department has been very illuminating as well as edifying from a native's point of view. No more brazen attempt to flout the intelligence of the people was ever

attempted. The whole undertaking is tantamount to official treachery. The department is just another glaring example of colonial hoodlum and legislative insanity. The Forest Trust as constituted savors of suspicion, doubt, and fear. Because we happened to be born under the Union Jack and are acquainted with British manners and traditions in their relationship with peoples of color, we do not object to the Colonial Office sanctioning a scheme that will provide shelter and food for a few of its underfed and incompetent servants; but when the scheme clashes with the welfare of those whose progenitors slaved without recompense that the Commonwealth of Nations may be kept intact, it is only right and just that their welfare take precedence over manners and traditions. If the Colonies must supply bread and butter for the heirs of the Commonwealth, then the guardians of this institution must understand that the citizens of the Colonies have a more sacred claim to life and the pursuits of happiness. The Forest Trust serves to remind us that as far as the pages of our history will turn, the Colony has ever been dominated by the will and desires of a group of ambitious merchants, land grabbers, brigands whose bags of gold obscure the vision, warp the intelligence, and twist the minds of a large number of our governors and legislators. The Forestry Department is a waste of public funds and should be immediately abolished. To ignore the wishes of the taxpayers in this respect is to say in so many words that British Honduras, like Kenya, Durban, and The Cape, is a White Man's Country."

The responsible government officials are nevertheless proceeding with the forestry work and no one is more whole-heartedly promoting it than His Excellency, the Governor, who makes it his business to see all parts of the Colony and work for the general good. The present Conservator, Mr. J. N. Oliphant, has a background of several years' practical experience in the Indian Forest Service, and associated with him are some technically trained foresters who are performing well their difficult assignments.

It was the writer's privilege to travel over a considerable portion of British Honduras during the past winter and observe the work of these men in the "bush," as the forest is locally known. They are applying to mahogany and cedar the principles which have proved successful with important East Indian timbers, and if this work is allowed to continue the future of the timber industry of the Colony seems assured.

The woods operations consist largely of locating seedlings, saplings, and half-grown trees of mahogany and other desirable kinds, and freeing them of some of the competition of the useless jungle growth—creepers, weed trees, and brush. Such "improved" trees respond quickly to the increased light and get just the start they need to outdistance the competition of worthless associates. There is no flouting of natural laws, but rather the control of them to man's advantage, with the result that one acre can be made to produce more and in less time than a dozen acres did in the wild state.

And this is by no means all that the foresters are doing. They have taken up the utilization of the secondary or inferior woods and are finding a market for them. Logs of these trees are now providing business for the Colony's only public railroad, reducing the deficit which this 25 miles of track has known ever since the banana business failed in the Stann Creek District and promising to turn it into a profit.

The hinterlands which have so largely remained *terra incognita* are yielding up their secrets to the systematic methods of reconnaissance and exploration used by the foresters. If a satisfactory route for a railroad to tap the Cayo District and give the great region of Peten, Guatemala, a ready outlet to the sea for its large stores of mahogany and chicle gum, it will probably be the foresters who blaze the trail through the rugged limestone mountains of the Coxcombs, for they are already about the task. And if it comes about that new and improved methods of securing chicle gum and stimulating its production bring back a share of that industry to British Honduras, credit will belong to the foresters who conceived and are carrying out experiments in the sapodilla forests around Honey Camp Lagoon.

The foresters are revolutionizing the old methods of finding mahogany trees and the laying out of roads and trails to get out the logs. They are making the way of the trespasser much harder than it was in the old days and also are pricking the bubbles of unscrupulous promoters of timberland schemes. These things are not conducive to popularity in certain quarters and account for much of the opposition encountered under various guises. So far good sense has prevailed in matters of legislation and will probably continue.

Forestry in British Honduras is not confined to the activities of the Government. The man who showed the way left the post of Conservator to assume the duties of manager of the Belize Estate & Produce Company, an English company which owns more than one-fifth of the lands of the Colony. The directors of this concern are

as fully convinced as Mr. Hummel, the manager, that forestry is a sound investment and now by the side of the loggers' camps are the camps of the forest workers. It is a new idea in Central America, but it is an idea freighted with much promise.

FORESTRY IN A CALIFORNIA COUNTY

By Everett R. Stanford
Assistant Forester, Los Angeles County, California

Los Angeles County, California, has a forestry department larger than that of many states, and indeed larger than that of the state of California. Its annual budget exceeds $300,000 and its permanent or year-long personnel includes 52 men. To many of those who know that this county is not in a commercial timber region this statement may come as a surprise and will naturally arouse wonderment as to what may be the peculiar problems of this section that call for such a large department.

Los Angeles County is in a semi-arid region, the topography is rugged and the mountains high, reaching in many cases over a mile above sea level, the highest peak being Mt. Baldy, 10,050 feet above sea level. For the most part these mountains embracing about 1,000,000 acres, are covered with "chaparral" or dwarf forest including scrub oaks, manzanita, several species of ceanothus, sumacs, chamise, wild cherry and California holly or "Toyon berry," which make up the major portion of the brush area. On portions of the higher and more remote sections of the county and intermixed with the chaparral there are, however, considerable bodies of trees made up of sugar, Coulter, digger, yellow, Jeffrey and pinon pine, white fir, incense cedar and big-cone spruce. Scattered over a large area also, particularly along the dry stream beds, there are the usual valley and live oaks, sycamores, poplars, willows, alders and other hardwoods so typical of the drier mountain slopes of California. In some of the pine bearing areas the general aspect is that of a real forest, and while the stand per acre is not heavy, individual trees are often of large size.

This large area of tree and chaparral growth creates influences of vast importance to the county. There are no mineral deposits so that the only resources are watersheds and recreation. It is the protection and improvement of these two resources that give the *raison d'être* for the county's large forestry department. The annual rainfall is light, averaging through the mountain regions around 24 inches a year, but it has a habit of coming in a few heavy showers and storms. During the long dry periods marked with low humidity and dry north winds the chaparral presents a particularly serious fire hazard. In the past some very serious fires have occurred and many have wiped out thoroughly

all vegetation over large areas. Some of these fires were of 50,000 acres or more in extent. While the city of Los Angeles obtains a large portion of its water supply from far outside the county, the county as a whole must depend to a great extent on the waters impounded from the watersheds within its own borders for both domestic and irrigating needs. Experience of the past has proven conclusively that the destruction of the vegetation on the mountain slopes threatens the prosperity if not the existence of some of the irrigated communities. The rains are often torrential, and when falling upon denuded slopes, they rip open new gullies and not only cause costly local floods but carry with them vast amounts of débris into the reservoirs or deposit it in the valleys. In the spring of 1925, for example, an ordinary rain caused great damage to a number of valuable orange groves and other agricultural lands, and covered more than a quarter of a mile of interurban car tracks with about 8 feet of mud, sand and boulders. This flood has been laid directly to the San Gabriel fire which not long before burned off the cover in the upper Monrovia and Fish Canyons.

While the county is deeply concerned in protecting its water resources it is also vitally interested in maintaining its mountains in some degree of verdure because of their important recreational value. The mountains of the county are traversed by many scenic highways and they are used by over a 1,000,000 residents and tourists annually as a playground. To a region which derives so much of its income from people attracted to it because of its climate and its recreational facilities, this feature alone is of distinct importance and is worthy of considerable effort to protect. In every case the welfare of the water and recreational resources of the county are menaced by forest or brush fires. It must be apparent therefore why the county has undertaken such a comprehensive program of fire protection.

In connection with the effect on water runoff of the removal of brush from the mountain slopes, some data collected for the county by engineers is of interest. A normal brush-covered slope will conserve about 80 per cent or 19.20 inches of the 24 inches of average annual rainfall. A denuded slope conserves only six per cent or 1.44 inches. The destruction of the water conserving capacity of a slope thus causes a loss of 17.76 inches of rainfall, equivalent to one and one-half acre feet the first year following the destruction. Based on the assessed valuation of the dependent lands this amount of water is worth $9. It is estimated that if additional fires are kept out the normal efficiency of a slope in preserving water returns after 25 years of protection.

The total loss, therefore, over 25 years is 12½ times the loss for the first year or $112.50 per acre. In 1923, there were destroyed 14,527 acres of forest and chaparral cover. The cost of the 1923 fires would therefore appear to be $1,634,387. The San Gabriel fire of 1924 burned over 50,000 acres principally in major watersheds. This single fire therefore, using the same values and omitting the great cost of its suppression, caused a water supply loss valued at over $5,600,000. One and one-half acre feet of water has been determined to be sufficient to supply the needs of 12 people for a year; the loss caused by the San Gabriel fire would thus theoretically have been sufficient to supply 600,000 people for 12½ years. Based on the average retail value of water for domestic service in southern California, less the cost of maintaining service, one and one-half acre feet of water is worth $77.75. This loss is sustained annually for a period averaging 12½ years. On this basis, the loss is $971 for each acre burned, and in the case of the San Gabriel fire of 50,000 acres this would be $48,550,000.

Fire protection in the mountain areas is the principal but not the only duty with which the Department of Forestry of Los Angeles County is charged. It is charged also with the planting and maintenance of ornamental trees on the county's highways, the care and development of county parks and the grounds of county institutions and the rehabilitation of fire devastated watersheds. The county forester operates two large nurseries, the one located at Altadena produced 700,000 hardy coniferous tree seedlings last year. Over 175,000 two-year-old trees were planted on various burned-over areas and give evidence of continuing satisfactory growth. More than 300 sacks of the seeds of various brush or chaparral species were this year collected and broadcast on over 5,000 acres of the Monrovia and Fish Canyon watershed, from which the natural brush cover was burned in 1924. Success in the plantings so far undertaken encourages the department in its belief that such reforestation in this locality is feasible. There is also some evidence, based on past plantings, that forest growth can be established on areas hitherto covered only with brush. Other activities of the Department of Forestry include surveys of insect infestations and parasitic diseases among the natural forest areas and the dissemination of information, and particularly the direction of public interest concerning forest preservation and reforestation. Due in no small part to the efforts of this department and its organizer, the late Stuart J. Flintham, a forester trained at Cornell and Yale Universities, there is an enlightened public sentiment and realization of the intimate

relationship existing between the maintenance of a good forest or brush cover in the Los Angeles mountains and the prosperity of southern California. This public interest has resulted in the formation of a number of local reforestation and fire protection organizations that co-operate heartily with the Department of Forestry. Another co-operative activity of the county organization has resulted in the establishment of a forestry division in the Los Angeles city schools system. The primary object of the program is to instill into the minds of the students of the elementary and secondary schools an appreciation of the value of mountain areas and the need for their protection and improvement. The administration of the city schools has seen fit to provide for two men on full time to organize forestry instruction.

The Department of Forestry, as it is known officially, is divided into what may be called divisions or bureaus, the important ones being Fire Warden (handles forest fires), Fire Department (handles construction fires), and Law Enforcement. In charge of the department is the County Forester, who carries also the titles of County Fire Warden, County Game Warden and District State Forest Ranger. The office of the County Fire Warden handles all matters dealing with fire prevention and suppression in the mountain brush and forest lands throughout the county in accordance with the provisions of various state and county fire protection laws. The area under protection is divided into six districts, each in charge of an Assistant Fire Warden, whose selection is based on his experience as a fire fighter and his ability to deal with the public. Each district has direct telephone connection with a central fire dispatching station at Pasadena. This station is a co-operative office maintained jointly by Los Angeles County and the United States Forest Service, inasmuch as a considerable portion of the county's watersheds lie within the boundaries of the Angeles National Forest. The two organizations co-operate under a written agreement. Supporting the county's district organization is a deputy warden force of 150 men, located throughout the area over which the county has jurisdiction; and in a county warehouse is a reserve store of equipment for a fire fighting force of 2,000 men. In the event of a conflagration of major importance, the organization provides for the detail of seven trained office assistants from their regular assignments to fire control duties. Dispatchers are on duty throughout the day during the fire season at all district offices and the Los Angeles headquarters. Six lookout stations have direct telephonic connection with the Pasadena and Los Angeles offices.

The Department of Forestry since its organization has built over 200 miles of fire breaks, traversing both county and National Forest lands. These firebreaks average about 50 feet in width. Their effectiveness in halting fires or as bases for attack has been frequently proven. To serve the breaks many miles of roads and trails have been built over the rough country. Not the least important has been the construction of three county-owned lookout towers. These, with three owned and operated by the United States Forest Service, offer excellent visibility of the entire mountain area of the county.

Unique in this organization is the inclusion of the administration of the County Fire Department and the coordination of its activities with those of the office of the County Fire Warden. The County Fire Department is concerned solely with the suppression of fires in the small unincorporated communities scattered throughout the county.

To conclude this paper a summary of the 1925-1926 budget will serve to indicate the nature and extent of the activities of the Department of Forestry of Los Angeles County.

BUDGET OF LOS ANGELES COUNTY DEPARTMENT OF FORESTRY

Control and Prevention of Fires		$232,152.00
Salaries and wages of forest fire fighting force	$56,072.00	
*Fire department, salaries and expenses	10,828.00	
Fire control	50,000.00	
Firebreak construction	50,000.00	
Roadside burning	10,000.00	
Fire patrol	15,000.00	
Aeroplane service	2,500.00	
Auto service	13,500.00	
Radio service and equipment	3,000.00	
Fire fighters' organization	2,500.00	
Miscellaneous service and equipment	18,752.00	
Protection of Fish and Game and Planting of Fish		7,848.00
Supervision of Forestry and Park Operations		84,870.00
Salaries and wages	$61,520.00	
Administration	3,100.00	
Reforestation (nursery)	3,000.00	
Reforestation (field planting)	2,500.00	
Reforestation (brush seeding)	2,500.00	
Planting and maintenance of roadside trees	8,750.00	
Insect infestation control	500.00	
Fixed property and equipment	3,000.00	
County appropriations		324,870.00
State and county co-operative fund		50,000.00
Grand total		$374,870.00

*The amount spent by fire districts in the county amounts to about one-half million dollars.

GROWTH IN MIXED HARDWOODS

By Leonard I. Barrett
University of Michigan

The purpose of the following study was to gather growth data on a 44-acre woodlot under management by the Forestry Department at the University of Michigan. Improvement cuttings and thinnings had been carried on for several years but no idea of the growth had been obtained although the working plans provided for a five-year period of return and accurate records had been kept of the basal area of each compartment and the amount of basal area removed at each cut. In making this study only two compartments comprising 20 per cent of the total area were considered.

A 100 per cent tally of these two compartments was made, each tree being recorded as to diameter and species. Diameters breast high were taken to 0.1 inch. Due to the fact that there were ten species to consider they were placed in the following groups, and each treated as one:

Black Ash—White Ash—Walnut	Oak—Hickory
Elm	Maple—Cherry
Ironwood	Basswood

Each species or group was then divided into four diameter groups as follows: 1—6 in. 6—12 in. 12—24 in. 24 in. plus.

In some cases representatives of one or two of the groups were absent. The number of trees in each 0.1 inch class was then obtained from the tally data and the total number of trees and the total basal area for each of the diameter groups in each species or group of species was then computed. From this data for each species or group of species the diameters of four average trees were obtained, one tree for each of the diameter groups.

After this had been done for both compartments field sheets were made out as shown.

Then going to the compartment in question two sample trees of the required diameter for each group were found. Each sample tree was measured as follows:

1. Heights obtained with 100 foot tape and Klausner hypsometer.
2. Diameter at base with diameter tape.
3. Diameters at 10 foot intervals above ground obtained by using hypsometer in combination with an especially built dendrometer furnished by Prof. L. J. Young.

SAMPLE FIELD SHEET

OAK-HICKORY GROUP. COMPARTMENT 2.

	D. B. H. Class			
	1-6 in. Sample Tree 3.0 D. B. H.	6-12 in. Sample Tree 8.3 D. B. H.	12-24 in. Sample Tree 14.7 D. B. H.	24 plus Sample Tree 29.2 D. B. H.
Tree No.				
Ht. ft.				
Diam. base				
Diam. 10 ft. up				
Diam. 20 ft. up				
Diam. 30 ft. up				
etc.				
Rings in last inch				

4. Increment borings were made in each tree and the number of rings in the outside inch of wood recorded.

The volume of each tree was computed by using Smalian's formula for that part of the trunk divided into 10 foot sections and the cone formula for that part of the tree above the last diameter taken on the trunk.

The volumes of the two sample trees in each group were averaged to find the volume of the average tree in that group. This was done for all groups in all species or combinations of species.

A growth per cent for each tree was computed by Schneider's formula. The numerator was varied with the diameter group as follows:

1-6″ class $\frac{500}{nd}$

6-12″ class $\frac{450}{nd}$

12-24″ class $\frac{450}{nd}$

24″ plus class $\frac{400}{nd}$

n = number of rings in last inch.
d = d. b. h.

These growth per cents were averaged for each diameter group. Next, the total volume in each group was found by multiplying the average volumes of the sample trees in that group by the number of trees per acre in it. Then by applying the growth per cent for that group to that volume the annual growth was determined for each group. The sum of the growths in the diameter groups of any one species gave the growth of that species. Following are the averaged results of the two compartments.

TABLE NO. 1

GROWTH PER CENT TABLE

Species	*Growth Per Cent by Diameter Groups*			
	1-6	6-12	12-24	24 plus
Ash-Walnut	16.07	2.45	1.44	
Elm	10.55	4.83	1.04	0.88
Ironwood	10.26			
Oak-Hickory	3.65	2.73	2.08	1.95
Maple-Cherry	14.32	3.45	1.88	
Basswood	18.55	11.11	1.20	1.12

TABLE NO. 2

TOTAL GROWTH PER ACRE PER YEAR

Species	*Growth in Vol.*
Ash-Walnut	2.33
Elm	4.23
Ironwood	5.42
Oak-Hickory	27.40
Maple-Cherry	2.43
Basswood	9.19
Total	51.00 cubic feet

If we consider this average growth on the two compartments as applicable to the whole wood lot the annual growth for the whole area equals 44x51 or 2,244 cubic feet. This means an average annual growth of approximately 22 long cords, or 66 short cords (16 inch).

TABLE NO. 3

NUMBER OF TREES PER ACRE

Species	*No. of Trees Per Acre by Diam. Groups*				*Total*
	1-6	6-12	12-24	24 plus	
Ash-Walnut	32	2.75	1.5		36
Elm	52.5	2	.38	.25	55
Ironwood	171.5				172
Oak-Hickory	26	38.5	18.75	2.25	86
Maple-Cherry	21.5	2	2		26
Basswood	92.6	2.5	.25	.13	95
Totals	396	48	23	3	470

The average number of trees per acre is 470 using the two compartments as a basis for computation.

TABLE NO. 4

Species	*Basal Area by Diam. Groups*				
	1-6	6-12	12-24	24 plus	
Ash-Walnut	.470	.552	1.695		2.717
Elm	1.683	.519	.509	.983	3.694
Ironwood	3.365				3.365
Oak-Hickory	1.612	14.834	23.039	10.055	49.540
Maple-Cherry ...	.321	.873	2.680		3.874
Basswood	2.120	.626	.620	.383	3.749
Totals	9.571	17.404	28.543	11.421	66.939 sq. ft.

There are 66.938 square feet basal area on the average using Compartments 2 and 7 as sample plots.

TABLE NO. 5

AVERAGE ANNUAL GROWTH IN B. A. PER ACRE

Species	*B. A. Growth by Diam. Groups*				*Total*
	1-6	6-12	12-24	24 plus	
Ash-Walnut	.082	.013	.024		.119
Elm	.176	.025	.005	.009	.215
Ironwood	.347				.347
Oak-Hickory	.059	.405	.484	.098	1.046
Maple-Cherry	.048	.030	.047	.004	.129
Basswood	.349	.073	.008	.004	.434
	1.061	.546	.568	.115	2.290 sq. ft.

Using 2,290 square feet as the average annual growth in basal area per acre, the total growth for the whole woodlot was found to be 100.760 square feet.

TABLE NO. 6

TOTAL VOLUME PER ACRE IN CUBIC FEET

Species	*Volume in Cubic Feet*
Ash-Walnut	65.19
Elm	90.20
Ironwood	52.66
Oak-Hickory	1302.22
Maple-Cherry	83.68
Basswood	83.52
	1677.47 average vol. in cubic feet per acre.

An inspection of the tables brings forth the following facts:

1. 84 per cent of the total number of trees per acre falls in the 1-6 inch d. b. h. class.

2. However 60 per cent of the basal area is found in the two diameter groups above 12 inches.

3. The growth per cent figures show a downward gradation from the smaller to the larger diameter groups.

4. The largest volume and basal area is found in the Oak-Hickory group.

5. The annual growth per acre is 51 cubic feet or 1.5 short cords.

Records of the cut, both in basal area and short cords (16 inch) have been kept since this woodlot came under management except for the first three years no basal area measurements were taken. The writer is indebted to Prof. L. J. Young for the following figures on the cuts, which were managed by him.

TOTAL CUT PER YEAR

Year	*Total B. A., Sq. Ft.*	*Total Short Cords*
1917		78.00
1918		32.00
1919		14.75
1920	32.428	41.00
1921	39.336	31.50
1922	40.832	62.50
1923	60.210	57.00
1924	67.188	64.00
Average cut per year....	47.999	47.59
Average growth per year	100.760	66.00

The heavy cut during the first year consisted mostly of dead and down material which was worked up into cord wood.

The field work and original report of this project was done by Mr. R. S. Bacon and the writer during the spring of 1924 and, while it is fully realized that there is considerable room for improvement in the study of such a complex problem, the methods outlined here or some variation of them may offer a practical solution of the difficulty.

LOGGING DAMAGE TO ADVANCE SPRUCE AND FIR REPRODUCTION

By Marinus Westveld
Northeastern Forest Experiment Station

The establishment of a series of permanent sample plots in the mixed spruce-hardwood region in the White Mountain National Forest prior to logging operations afforded an opportunity to record the damage to reproduction and young growing stock as a result of logging.

All trees one inch and above in diameter at breast height were tagged previous to the cutting. In addition, an accurate tally was made on a series of reproduction strips which comprised 17½ per cent of the total area of the plots. This tally was made by species and height classes, and included reproduction up to one inch in diameter. Therefore, a truly representative tally of all classes of material was secured previous to logging.

The spruce-hardwood type, in which the plots are located, covers a considerable portion of the spruce region and is undoubtedly the most difficult type to handle from the standpoint of the production of spruce. Any system of cutting involving the removal of spruce tends to increase the percentage of hardwoods. Ordinarily, the relative amounts of conifers and hardwoods in this type vary greatly, the volume of hardwood comprising anywhere between 25 per cent and 75 per cent of the stand. A tally made previous to logging showed the plots contained a slightly greater amount of hardwoods than spruce.

The type of horse logging common to the region was employed. This consists of skidding logs in tree length down skid trails to the landings where the logs were loaded on double sleds and hauled to the railroad spur.

After the area had been cut and logged, a check was made on all trees marked for removal, and a tally made of all trees which had been destroyed in the process of logging. In making a re-tally of the reproduction a separate record was made of reproduction covered by brush and that destroyed by logging. The following table summarizes the amount and kind of material retained for future growth and the amount of damage entailed through logging. All of the reproduction recorded is advance reproduction, the tally being made early in the spring following the winter's logging and before any new germination had taken place:

STAND DAMAGED BY LOGGING AND STAND LEFT AFTER LOGGING

Size Class	Spruce and Fir		Merchantable Hardwoods	
	% Loss through logging	No. left per acre after logging	% Loss through logging	No. left per acre after logging
Ht. in ft.				
½′	15	2318	22	4912
1′	24	866	16	755
2′	21	257	38	119
3′	21	128	33	59
4′	26	94	28	20
5′	27	60	0	21
D. B. H. in inches				
1″— 3″	24	98	25	48
4″— 6″	19	26	16	52
7″—12″	17	20	6	32
13″—30″	0	8	0	16
Total	18	3875	22	6034

It will be seen that there is an abundance of reproduction both of conifers and hardwoods left on the ground even after the area has been logged. This is particularly true with respect to the small size classes. The average number of conifers left to the acre is 3,875 against 6,034 hardwoods, a representation respectively of 39 per cent and 61 per cent. The average loss of conifers through logging amounts to 18 per cent, while hardwoods suffer a loss of 22 per cent. It will be noted that the percentage of loss in the 6-inch height class is less than in the larger size classes. This is due partly, at least, to the fact that the area was logged during the winter. The blanket of snow on the ground at the time served to protect this small reproduction from destruction.

Originally, the two to five-foot classes contained 700 conifers to the acre and 332 hardwoods, a representation of 68 per cent and 32 per cent respectively. The representation of conifers in these classes was still further increased through the greater destruction in this class of hardwoods than conifers, the loss being 34 per cent in the hardwoods and 23 per cent in the conifers. The highest percentage losses in conifers occur in the two to five-foot height classes, where the number of thrifty, fast growing saplings are reduced from 700 to 539 to the acre.

Although spruce and fir reproduction on the plots as a whole may be considered fairly abundant, yet hardwood reproduction is nearly twice as profuse as the spruce and fir. The great bulk of the coniferous reproduction is contained in the one-half and one-foot height classes, which claim 82 per cent of the entire number. To be exact, 3,184 fall in these extremely low height classes. The balance of 691 conifers are distributed among the larger classes. If we were assured of a fair per cent of ultimate survival in the one-half and one-foot classes the logging damage sustained by the larger size classes would not be such a serious matter. Very often, however, dense thickets in the form of brake, raspberry bushes, or rapid growing weed trees and hardwoods spring up at once on these cut-over areas and only too often succeed in submerging vast quantities of the small spruce and fir. Young hardwoods, on the other hand, possess a great capacity for height growth and quickly overtop and suppress the small conifers which appear to be unable to keep pace with the rapid growing hardwoods. The spruce and fir reproduction, comprising the two to five-foot classes, it is believed, has attained sufficient height to maintain its ascendancy and to compete successfully with incoming hardwoods and other hostile growth for a permanent position in the new stand.

Studies of height growth of spruce and fir reproduction show that this class of reproduction responds vigorously and puts on rapid height growth following the removal of the mature stand. The original tally showed the presence of 700 of these young conifers to the acre. Unfortunately, nearly 25 per cent of this number were destroyed in the process of logging, leaving 539 to the acre. Even under favorable conditions it requires from 15 to 20 years for spruce and fir seedlings on cut-over lands to reach breast height. The importance, therefore, of exerting every effort possible to reduce losses in this class of young growth can hardly be over-rated, since it is on seedlings of this size that we must largely pin our faith for a new crop of pulp wood. In this advance growth also lie the possibilities, in a small measure at least, of cutting down the length of the rotation. The swamping out of considerable amounts of unmerchantable hardwoods, 44 per cent of the larger size classes, is also a direct benefit to the young coniferous stand, since competition resulting from the rank growth of hardwoods seriously retards the development of young spruce and fir. However, a question is raised regarding the really beneficial effects of the removal of young hardwood growth on spruce and fir reproduction. In some instances cutting of hardwood growth results in such vigorous sprouting

that this new growth is more hampering in its effect on the development of the coniferous seedlings than the original growth.

There are many factors operating, particularly following logging, to diminish the representation of spruce and fir in the succeeding stand. Far from being the least of these factors is the indiscriminate destruction of well-established, fast-growing coniferous growth, comprising the larger size classes, in the process of logging. Its destruction is responsible in no small degree for the rapid conversion of mixed spruce-hardwood stands to pure, or nearly pure, stands of hardwoods.

REVIEWS

"Atlas of American Agriculture." Part I, Sec. E, Natural Vegetation. By H. L. Shantz and Raphael Zon, U. S. Department of Agriculture.

The joint authors, in this publication, have provided in compact and concentrated form an excellent description of the natural vegetation of the United States. It is intended primarily for the non-technical public, and in general the materials are so presented as to be easily intelligible to that type of reader. It will be very useful, at the same time, to scientific workers, particularly to ecologists and those engaged in the economic fields of forestry and agriculture. A skillfully executed vegetation map is a special feature, and the numerous illustrations are exceedingly well chosen.

The main divisions are the natural ones, forest, grassland and desert shrub. In the first, contributed by Mr. Zon, we find a separation into western and eastern forest regions. The western region includes two units of woodland, chaparral and pinon-juniper; and three of timberland, western yellow pine-Douglas fir, cedar-hemlock, and spruce-fir. The eastern region (all timberland) comprises seven units: spruce-fir, white-Norway-jack pine, birch-beech-maple-hemlock, oak, cypress-tupelo-red gum, longleaf-loblolly-slash pine and mangrove. Many of these larger groups are further subdivided.

Dr. Shantz distinguishes seven units of grassland: tall grass, bunch grass, short grass, mesquite grass, mesquite and desert grass, marsh grass, and alpine meadow. Under desert shrub vegetation, also treated by Dr. Shantz, we find three main groups: sage brush, creosote bush and greasewood.

The general plan for each type comprises description of the composition of the community, with local variations noted, its range, and something as to the climatic conditions under which it exists. Since the work forms part of an Atlas of American Agriculture, a paragraph is added dealing with the present economic uses and future possibilities of the region under discussion.

In order that such a work may be scientifically useful, the basis upon which the division into types is made must be a scientifically sound one, and the treatment upon that basis must be consistently carried out. In the large there are two possible bases, one grounded upon environmental differences as determiners of the vegetational regions, the other upon the vegetation itself. The first, exemplified by the temperature-zone system, is now largely discredited. Such *modern*

treatments as those by Transeau[1] and Livingston and Shreve[2] base their divisions upon purely vegetational differences, appealing to the environmental phenomena for an explanation of these.

The present authors base their work "largely on the distinctive features of the vegetation itself," certainly the only logical method. It is particularly gratifying to one having a deep faith in the principles of dynamic ecology to find here abundant recognition of the importance of the great fact of change. It is not the final end of scientific endeavor to describe things merely as they are at the present moment. In the first place, it is unscientific to disregard the processes which have brought about the present state of things and which will determine the future—to concentrate attention upon the evanescent phenomena of the mere moment of our individual lifetime. In the second place, it is economically unsound to assume that the things of tomorrow will be exactly those of today and susceptible of the same mode of treatment and use. All credit is therefore due the authors for their recognition of the fact that forests and other plant communities are changing, not static phenomena.

At the same time, unfortunately, their method of presentation of this fundamental truth is not free from fault. There is no clear introductory explanation of the method to be followed; we are left to discover it for ourselves as we read into the body of the work. The statement (p. 17) that "the communities discussed in the larger type are true climax and are known as associations; those in smaller type are developmental for the most part and are associes" is perfectly clear to an ecologist, but to the layman, totally unaccustomed to the dynamic way of thinking and to ecological terminology, it must be utterly meaningless.

In the section upon forests, particularly, the method is confusing. In large part it is a purely static description of the communities, the phenomena of change and development apparently being considered as more or less incidental and occasional. Nothing is said of the successional relations of the bog trees in the northeastern forest, certainly as clear-cut a case of vegetational change as it is possible to find. The same is true of the developmental relations existing between the three northeastern pines. The most thorough elaboration of successional

[1] Transeau, E. N. Forest Centers of Eastern America. Amer. Nat. 39: 875-889. 1905.

[2] Livingston, B. E., and Forrest Shreve. Distribution of Vegetation in the United States as Related to Climatic Conditions. Carnegie Inst. Wash. Pub. no. 284. 1921.

processes is given in the discussion of the cedar-hemlock forest of the Northwest. This is divided into two "regions" (more accurately, types), the western white pine-western larch and the Pacific Coast Douglas fir. In each the course of succession is outlined, and both are said to gravitate toward the same ultimate forest of western red cedar and hemlock. Inasmuch as there is no intimation that any mature areas of this final forest actually exist—since it is apparently a pure abstraction indicated merely by the understory in the late successional stages—the unprofessional reader must surely find himself non-plussed by the term "cedar-hemlock forest." Such a case, stated in this way, might even be considered too hypothetical even by the dyed-in-the-wool dynamic ecologist. In short, we are led into the realm of vegetational change just far enough to become hopelessly lost.

With regard to matters of detail the present reviewer feels competent to speak only of the section on forests. The conception of chaparral adopted by the author seems totally unjustified, and the treatment in its several parts lacks consistency. "Chaparral is a mixed forest of stunted hardwood trees and shrubs" (p. 8). But in the summary on page 15 we find listed as important members of the California chaparral such large trees as *Quercus californica, Q. douglasii, Q. chrysolepis, Q. agrifolia, Q. wislizeni, Q. lobata* and *Q. garryana;* and, still more strangely, no mention of the important shrub constituents, members of the genera *Adenostoma, Arctostaphylos, Ceanothus,* etc., and the truly shrubby oaks; though brief mention of these genera is made elsewhere. Certainly forest made up of trees averaging two to four feet in diameter and attaining seven feet as a maximum, with a spread of branches exceeding one hundred and fifty feet, does not deserve to be classed as "forest of stunted hardwood trees," nor can it logically be included with the chaparral, which is made up mainly of obligate shrubs with a mere scattering of potential or "stunted" trees. Forests composed of the oaks listed above, together with members of such other genera as *Pasania, Arbutus* and *Umbellularia,* though they seldom form continuous masses of great extent, nevertheless constitute a definite and characteristic feature of the typically Californian vegetation. If these be chaparral, then the burr oak forests of the Middle West are chaparral, and it would require but a slight further straining of the term to make it cover all our oak forests, wherever situated.

Under the heading, "Correlation of Forest Vegetation," and in sundry other places, the author points out certain cases of alleged sym-

metry in the arrangement of forest communities. For instance, taking the eastern oak forest as the center, we find immediately north and south of it stands of hardwoods mixed with pines, both grading into pure pineries, and beyond these, on the north spruce-fir, on the south mangrove. Considering the very different species involved in the northern and southern forests the coordinate character of the pairs is not very impressive, and it is hard to see why spruce-fir should be matched with mangrove. Granting the symmetry, the question may well be asked—has it any significance?

In several cases there is an attempt to show correlation between pairs of forest regions, eastern and western. It is indeed difficult to discern any important parallelism between such forests as the birch-beech-maple-hemlock and the western white pine, or between the eastern oak and the Pacific Coast Douglas fir. The evidence offered is unconvincing, and, after all, such striving after correspondences and symmetry, merely for their own sake, seems a pointless undertaking.

The forester, because of his position midway between the student of pure science and the general public, has a unique opportunity to aid in the invention, establishment and popularization of logical and appropriate common names for our native trees. Failure in this respect in the present work is merely an instance of a fault prevalent in the literature of American forestry—a too easy acceptance and constant use of common plant names that are inappropriate and misleading. A flagrant example is "western red cedar," used to denote *Thuja plicata,* which implies a relationship to some "eastern red cedar." This at once brings to mind *Juniperus virginiana,* a totally different tree, and, in turn, itself not a cedar at all. In this case the name objected to is entirely superfluous in the presence of such a distinctive cognomen as "western arbor vitae." Another case is the use of the name "yellow poplar" for *Liriodendron tulipifera,* which also possesses the name "tulip tree," a singularly appropriate one. In one place it is called simply "poplar," just as *Thuja* is spoken of as "cedar." Certain names thus transferred to new owners are doubtless so firmly fixed that it would be impossible to replace them; but in very many cases an organized effort on the part of writers upon forestry would do much toward establishing a logical and attractive popular nomenclature.

One minor point relating to the work as a whole: the proof reading has been strangely faulty with regard to scientific names of species. Eighteen of these misspelled is too heavy a score for a work of this size.

A few words in conclusion must be given to the map. It is spoken of as generalized, which is necessarily true of any such undertaking, but it appears to be as detailed as is possible upon the scale selected. Any one intimately familiar with a given area will be able to point out slight inaccuracies, but it would be an ungrateful task to pick flaws in this fashion. Within the limitations imposed by the impossibility of two authors obtaining a personal view of every portion of the country and the equally impossible task of drawing sharp boundaries between types, the map gives us an adequate and satisfactory view of the vegetation of our country.

—William S. Cooper

"Forest Administration in India," by D. N. Bonnerjea, International Review of Agricultural Economics, New Series, Vol. III, No. 4, October-December, 1925, pp. 610-642 (published by the International Institute of Agriculture, Rome Italy).

This very interesting article covers the development of modern forestry and the present forest administrative organization in British India. The writer is not a forester. This makes the article all the more interesting because it records the impressions made upon an outsider, apparently an agricultural economist, by the work of the foresters.

At the time of the Aryan invasion, about 2000 B. C., India was a heavily forested country. The Aryans were an agricultural people. Clearings had to be made in order that they might carry on their agricultural operations. The forest, however, was destroyed only very slowly. In northwest India the forests along the Salt Range and the Jhelum River were still sufficiently extensive and dense, at the time of the invasion of Alexander the Great, so that they concealed the movements of his army. Even much later, that is, in 650 A. D., the famous Chinese traveler, Hieum Tsiang, reports a temporate and salubrious climate, undoubtedly due to the great extent of the areas still covered by forests. The reduction of the forested area to a harmful extent did not begin until the eighth or ninth centuries A. D. Since then shifting cultivation and increased exploitation of the forests to satisfy military, naval, fuel and commercial requirements has reduced their area greatly and has brought about serious erosion. Grazing, together with the accompanying burning of the forests to improve the range, is also an important factor in forest destruction.

While crediting the foresters with "great and notable achievements" such as the stopping of shifting cultivation, the organizing of effective fire protection, the development of successful silvicultural practices and

the proper controlling of timber cutting operations, the author points out that "a really profitable connection between the extensiveness and proper conservation of forests and their practical, demonstrable utility in actively helping agriculture has yet to be discovered" and that the withdrawal of such large areas as have been served for forestry purposes has inflicted hardship, although unintentional, upon many individuals. He maintains that the use of land for forestry purposes can be justified only when its use for such a purpose can be shown beyond dispute to benefit agriculture. In this connection he states that "one of the vital necessities of agriculture which a properly developed forestry can subserve is the organization of fodder and fuel reserves." There are about 243,000,000 acres of publicly owned land within British India which might be developed as village forests, primarily for the purpose of supplying these villages with fuel and reserve range. The possession of reserve range, to be used during periods of severe draught, is of great importance to the villages because of the importance of oxen in agricultural operations and the heavy losses amongst them caused by draught when no forage reserve is available. The forests provide such a reserve because the forage within them remains usable long after that in the open country has disappeared.

In getting the practice of forestry definitely established the foresters have had many serious difficulties to overcome. At first the civil authorities felt that the foresters were unnecessary and were taking over work that belonged under their jurisdiction. This feeling caused considerable obstruction. Furthermore, there was an influential element among the civil authorities who felt that the forest occupied too large an area, and that, instead of reserving forested areas, the government should bend its efforts toward clearing these areas so that they could be used for agricultural purposes. Another serious obstacle was the right which the native population, through immemorial use, had acquired to pasture their livestock upon the public forests and also to take therefrom whatever wood they needed. Then too, the forest administration suffered for a long time from the great scarcity of men properly trained for carrying on the administrative and technical work upon the "reserved" and "protected" forests. However, about the middle of the last century there began to develop a real fear among an influential group of British administrators that the Indian forests were not inexhaustible and that, unless they were given proper care, a real fuel and timber famine would develop. It is worth noting that between 1840 and 1900, in spite of the pressure of a very dense population, 100,000 acres of waste land

in Bengal, Madras and Bombay were planted to forest trees, these plantations being established primarily to partially relieve local wood shortages. As a result of the tug-of-war between these various forces involved an area of about 180,000,000 acres of forested public domain has been definitely set aside as forests and put under administration.

Within these forests the foresters have had to struggle against two "rights of user" which were particularly destructive to the forest, namely (1) shifting cultivation and (2) the grazing of the forest lands by nomadic bands of cattle. It was pointed out in the government of India's dispatch to the Secretary of State for India, dated November 1, 1862, and fully approved by the latter, that "the recognition of *private rights* in government forests was not compatible with the responsibilities of the government as the custodian of public interests." Keeping this statement of policy ever before it, the government has been extinguishing, as rapidly as possible, all rights of user. The principal method followed in accomplishing this purpose is the purchase from the right holder of his right by the government. Of these rights, the most destructive to the forest was the right possessed by the hill peoples, who are non-Aryan and are probably descendents of the aborigines, to engage in shifting cultivation. This right has now been entirely done away with within the "reserved" and "protected" forests. A detailed description of the routine followed in carrying out this form of cultivation is given by the author.

Even more difficult to handle than shifting cultivation was the grazing situation. Vast herds of cattle were being grazed within the forests by nomadic owners. These owners were in no way connected with the local agricultural population. But they had used the forests so long that both the native Indian and the British officials considered that they had acquired a well established right to use them. The number of cattle being grazed by these nomads within the forest was so great that much direct damage was being done to the forest. Furthermore these cattle owners were regularly resorting to burning over the forests, near the end of the dry season, in order to improve the forage when the rains did come. While grazing could not be prohibited, because of the hardship which prohibition would work upon the livestock owners, yet it could be *regulated,* and regulated it was.

Both the foresters and the civil administration now believe that a considerable forest area should be definitely closed against all grazing except during periods of unusually severe draught. Putting this belief into practice, they have closed, permanently or temporarily, 21,592,320

acres to all grazing except during periods of extreme draught, and an additional area of 18,013,440 acres to sheep and goat grazing.

While fire protection is considered an important function of the Forest Service, apparently less than one-tenth of the forested area under administration is protected by fire lines. In 1923, which was probably an average year, less than 2 per cent of the gross receipts from the forests was used for the construction and maintenance of fire lines.

According to the author, utilization has been and still is backward. In the first place there is a good market, even in India, for only a few of the many species present in the forest. In the second place, the Forestry Department has never had an adequate sum of money available for advertising Indian woods or in other ways developing markets for them. In the third place, outside of the areas served by good natural water transportation, cheap and efficient transportation within the forests has not yet been provided except in a very limited way. Only 2 to 3 per cent of the gross income of the forests is spent on the construction and maintenance of transportation routes. In the fourth place, the freight rates on the State Railways are so high that timber can not be shipped over them on a large scale commercially.

After considerable experience with contractors, the Forestry Department has come to the conclusion that it is advisable to do most of the logging itself. With reference to further development, the author suggests that the work of the Forest Research Office, an office which has only recently been added to the Forestry Department, ought to be greatly extended, and that one of its functions ought to be the developing, in the neighborhood of the forests, of wood-using industries.

The development of the administrative organization in India and of forestry education in England and India are described in considerable detail. At first the greater part of the higher staff was drawn from the Army and the Public Works Departments. In due time the government came to realize that the forests must be cared for by properly trained men. This realization resulted first in the sending of men to France and Germany for training, and, later on, the establishment of forest schools at Coopers Hill (England) and Dehra Dun (India). The lower grades of the service have always been recruited from amongst the natives. At first the rates of pay received by these men were very low and the conditions under which they worked were very bad. In recent years, however, this situation has been greatly improved.

Taken as a whole, this article is a very interesting and informative description of forestry and forest administration in India. The author,

a man apparently without forestry training, brings out several points which a forester does not often think of.

—J. H. A.

"Organization of The Forest Service in Finland." Digest from Proceedings of Finnish Forest Excursion of June 26-30, 1925.

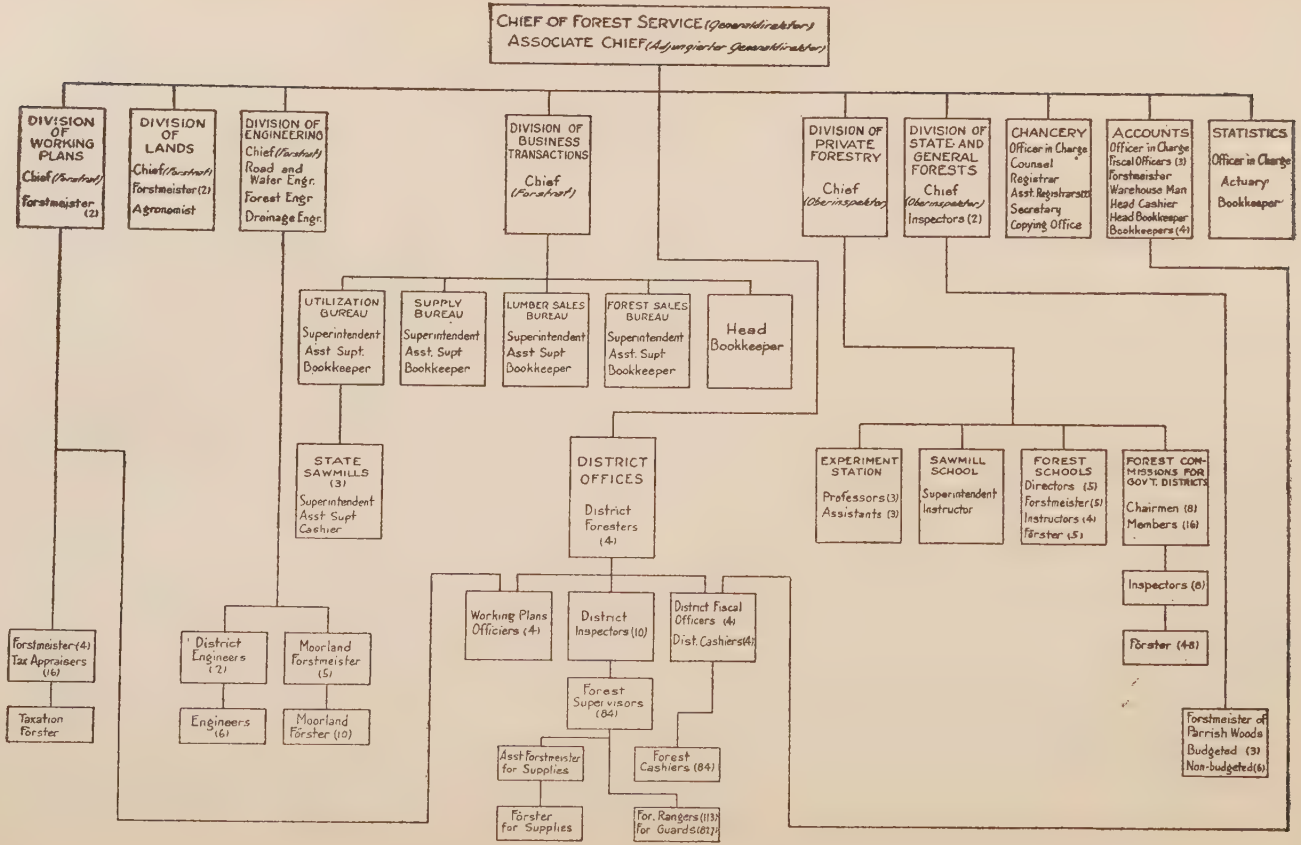
The interesting feature to American foresters of this article by Dr. A. K. Cajander is its chart showing the organization of the Finnish Forest Service. The article is in German and, aside from the schematic presentation of the forest organization, only a few historical and explanatory facts are here given.

Forest work in Finland was organized in 1851 according to districts (bezirke) with one Forstmeister for each district. In 1859 the prevailing scheme of forest organization in central Europe was established in Finland, although the higher forest officers were still attached to the Land Survey. It was not until 1863 that an independent forest service (Forstdirektion) was set up. Further improvements in organization were made in 1876, 1908, and 1921.

Before the World War the state forests contained 12,572,863 hectares. At the time of the peace treaty of Dorpat (1920), Finland acquired additional state forests, which brought the total up to 14,111,-306 hectares. The large forest bodies and by far the greater part of the total forest area are located in the northern half of Finland. Small state holdings, which appear to be about the size of our recently established military forests, are scattered over the southern half of the country.

In the accompanying organization chart, titles of forest officers appear in English, except in such cases where translation could not be made into a generally accepted English equivalent. In several cases the German title is given in parenthesis after the English in order to indicate professional standing. Forstrat, for example, which is a title of a high-standing forest officer, has no good English equivalent in America. More or less literally translated, this would be a member of a forest cabinet. The position as shown on the chart is probably comparable to an Assistant Forester of the U. S. Forest Service Forstmeister apparently applies to all technical foresters in scientific and administrative work up to the position of Forstrat. Förster is ordinarily translated as forest ranger. Forstwart is a forest guard. Revier Forstmeister is translated into forest supervisor.

ORGANIZATION OF FINNISH FOREST SERVICE



The total personnel in the organization, as shown by the chart, is 1,356. This includes the entire technical and administrative personnel, but apparently does not include scientific apprentices, woods workers, and the under clerical force. Of the total number of the personnel given, 220 appear to be attached to the central office (Forstdirektion) and 1,136 to the field organization.

—R. H. W.

"Some Aspects of a Study of Leadership." By H. C. Ramsower. Published by Ohio State University in mimeographed form.

The qualities essential to successful leadership in professional work are analyzed in this paper. It presents the results of a scientific study of the most successful and least successful county agricultural extension agents. Each state leader was asked to grade the county agents of the state in the order of achievement and success in the work. Then in each state the two best and the two poorest agents were rated by the leader on the following qualities: Broad knowledge and interest; technical knowledge; commanding presence; faith; enthusiasm; courage; vision; ability to plan and organize; power of expression; resourcefulness; initiative integrity; tact; perseverence; friendliness; tolerance; unselfishness; sympathy; co-operation. Each man was rated in each of these qualities as superior, good, fair or very poor. From a total of about 1,400 agents in 34 states, 133 agents were rated by 143 persons.

The superior agent was found to possess seven qualities which rank close together and above all others. In order, they are integrity, perseverence, faith, ability to plan, vision, initiative and courage. Technical knowledge, that quality which in fair degree is indispensable to the success of any agent, representing more than any other the field of endeavor in which the agent works and which in the common mind he is hired to develop among farmers, ranks far below those enumerated. This does not in any sense show that technical knowledge is unimportant or any less important than any one of the other qualities, but only that, no matter how proficient one might be in subject matter, without the seven qualities stated one would have little chance of achieving success as a county agent.

The poorest agent is conspicuously lacking in four qualities, namely enthusiasm, vision, ability to plan and initiative, *and in no others* do the D, or very poor, ratings exceed all others. These are identical with those qualities in which the best agents ranked highest. The poor agent is not rated particularly low in technical knowledge; the best agent

received as many B (good) ratings as did the poorest agent. Why is this near-failure so poor in these most necessary qualities? He is fairly well equipped with technical information. Is it possible then that teaching methods in our colleges of agriculture are so ordered as to give their students fact and information but give little training in the fundamental educative process of thinking? The author asks these questions and then states his conclusions as follows:

"This study lends emphasis to the statement that that is precisely what we do. Even a cursory examination of our class room procedure leads to the conclusion that those qualities more than all others which are developed in the student are those of absorption and retention. In spite of all our educators have sought to teach us we complacently proceed with our age-old habits and customs and pass out fact and information rather than teach proper procedure in problem solving. Our helpless pupils are compelled to sit through hours of lectures filled to overflowing with useful information, absorbing what they can, and when the pressure of a quiz or written test is applied, their job is to return what they received in a form as nearly like the original as their powers of retention and expression permit."

* * *

"I fear there is the firmly implanted notion in the minds of technical men that a few more additional facts which can be given only through another course are quite essential to the success of the student in whatever job he may subsequently find himself. We would not condemn specialization, not at all. It is highly desirable for a certain small group of students but this study indicates that generalization in broad fields of knowledge rather than specialization in narrow fields would be more potent in leadership development."

—S. B. D.

"Forest Management," Second Edition. By A. B. Recknagel, John Bentley, Jr., and C. H. Guise. John Wiley & Sons, N. Y.

In the first edition of this text in 1918, the author sought to present in a single volume a condensed summary of three subjects, Forest Mensuration, Forest Organization and Forest Valuation, in such a form that it would fill the immediate needs of undergraduate students of forestry or of forest land owners, avoiding on the one hand the extreme simplicity of elementary treatises on forestry and on the other the extended and complete professional treatment required by a fully equipped forester to meet all the problems arising in the practice of his profession.

In the second edition this plan has been adhered to, and the only change has been to improve the text by adopting more modern and better treatment.

The book is exactly what it pretends to be. It will not take the place of the more advanced textbooks or publications on any one of the three subjects treated, though for the purpose of the average practicing forester it is probable that the part on Forest Valuation comes nearest to supplying his needs in this respect.

Forest Mensuration is covered in 132 pages. The limitations of space and consequent abbreviation of material make it necessary for the student to refer to other texts for an understanding of such points as the use of the graphic method in constructing volume tables. The author in discussing the determination of the age of slightly uneven-aged stands gives only one, and that the least accurate method, based on weighting age on respective numbers of trees in each of several groups. In stem analyses for volume, reference is necessary, likewise, to original sources. These and several other references, published in the original edition, are to Graves' Forest Mensuration which is out of print and were not corrected for reference to its successor, Chapman's Forest Mensuration which republished this material.

In the construction of yield tables, the only method given is Baur's in which site qualities are derived directly from plotted volumes, giving no basis for application in field work. The entire literature and practice of yield table construction and standardization based on height growth has been ignored, leaving the amateur student with no real foundation in the subject.

The method proposed for recording the results of stem analyses is worthy of commendation. Timber estimating is covered in a practical and satisfactory elementary manner. Nowhere is the important subject of application of increment studies to the problem of determining growth on large areas presented adequately. Aerial surveys have been added.

The same lack of basic thoroughness is revealed in Part II, Forest Organization, which is covered in 37 pages. The formula for determination of so-called normal growing stock is incomplete by omitting the multiple $\frac{\text{Area}}{\text{Rotation}}$ by which the initial computation must be adjusted to the actual forest, though it is later stated that for one acre the division is $\frac{1}{R}$. The most serious defect of this discussion is

the failure to distinguish the "normal" growing stock required for regulation of the present forest, from the ideal or fully stocked forest, by pointing out that the former is based on actual average increment and is the only possible basis of regulation in the present rotation. The use of the normal yield table as a basis of determining the surplus or deficit of existing growing stock would give absolutely erroneous results and tie up the present forest capital.

Under rotation, some inaccuracies and omissions appear. The rotation is usually expressed by a definite year, not by a period of 10 to 20 years, though such a period is used over which to regulate the cut. Any other conception of the rotation is confusing. No discussion appears of the silvicultural factors affecting rotations.

In the discussion of the working circle no mention is made of the economic basis of this subdivision, which is the ability to produce a constant flow of products capable of supplying a definite and steady demand, preferably local in its character.

Throughout the discussion of methods of regulation of the cut on pages 162 to 170 the author has failed to distinguish between a check on the amount to be cut, and its practical determination. For instance, Von Mantel's and Heyer's methods are merely volume checks. The area method is an area check only, as described. Chapman's horizontal cut, as described, is merely a silvicultural or stand method check. It is correctly stated that the surplus or deficit must be reduced, but it is not pointed out how this is to be attained, in the case of the area or of Chapman's method, or how and on what basis the final decision on the annual cut is to be made. In the Chapman method, this consists of raising or lowering the diameter limit indicated by the method. In the area method it consists of cutting more or less than the indicated area; while in the Heyer volume check, the period of regulation can be modified. On the whole however, this brief summary of organization should serve to acquaint the reader with the scope and contents of the subject.

In Part III, Forest Valuation, which has been expanded to 124 pages, the only conspicuous flaws noted were the confusion of profits and entrepreneur's gain on page 211, the failure to point out the conditions governing the table on page 214 which introduces expenses at P and not x per cent, hence, does not give the true rate earned; and the failure to identify the income per acre on page 215 as net forest rent.

In the discussion of forest rent versus soil rent, the meaning of the latter is obscured by describing it as the accumulated compound interest on the soil at the end of the rotation. The ordinary conception is that soil rent is the annual interest at P per cent on this capital value of soil, hence, bears at all times the relation Sv (op.) = Soil rent.

Every chapter, in Part III, which includes economics of forest finance, growing and holding timber, forest property valuation and drainage, stumpage values, taxation and insurance, shows a conscientious effort to simplify and condense the available and necessary material without loss of clarity and the result is to be commended. Important additions to the text are the inclusion of a Forest Service management plan, and a chapter on Planting Surveys by Prof. S. N. Spring.

The book as a whole should fill the need for which it is intended, with a very fair degree of satisfaction.

—H. H. C.

"The Kiln Drying of Lumber." By Arthur Koehler and Rolf Thelen, U. S. Forest Products Laboratory. 293 pages, 113 figures, 6x9 inches. McGraw-Hill Book Company, New York, 1926.

With the publication of this text another book is added to the growing list of works on forestry and lumbering. Ten years ago a mere handful was available. In no field are text books—good text books—so badly needed. With but very few exceptions the books on forestry and lumbering are of a very high order. This book by Koehler and Thelen is well up to that standard. Since the publication of Tiemann's excellent book of the same title, the pioneer American text on kiln drying, additional knowledge of the subject has been gained, not only in the theory of drying but also in the design of kilns and their operation. The new text embodies this information and furthermore presents it in a style at once readable, interesting and quite useful. A dry kiln operator's office is not completely equipped if it does not have on its shelf a copy of Koehler & Thelen's "The Kiln Drying of Lumber." There is a growing and genuine desire on the part of kiln owners to improve their drying practice; but they have been handicapped in obtaining men as operators who have the requisite training in or knowledge of wood and its handling. It has been difficult in the past for the really interested operator to obtain kiln drying information from an easily comprehensible source. Also, kiln drying to many is full of mystery. Koehler & Thelen's book is so simply

written and the arrangement is so logical that the mystery is dispelled and a genuine interest in the subject is developed.

The book quite properly opens with a chapter generalizing on the purposes or "whys" of seasoning lumber, particularly by "artificial" means. Kiln drying and air drying are compared from the business standpoint and the relative merits of the dried lumber. "Enough experimental work has been done . . . to indicate that *with proper care* all kinds of lumber can be dried in a kiln with fully as good results, as far as the quality of the lumber is concerned, as can be obtained in air drying."

In order to properly appreciate the phenomena associated with the drying of lumber, the operator must have an understanding of the cellular make-up of wood. Chapter II is a clear and easily understood exposition of the structure of wood and its relation to drying. In this chapter a paragraph is devoted to the fibril theory of cell wall structure, according to which the walls "are believed to be made up of exceedingly fine particles or threads which extend in the wall in a spiral direction" . . . "These fibrils are believed to be exceedingly numerous and so close together in normal wood that they have a strong mutual attraction for each other." But their attraction for one another is believed to be less than their affinity for water, with the result that each fibril surrounds itself with a film of water and thus keeps itself separated from neighboring fibrils. "As moisture leaves the cell walls the film of water between the fibrils becomes thinner, the fibrils draw closer together, and the wood shrinks as a whole. The absorption of moisture causes the fibrils to separate somewhat and the wood to swell." Another paragraph in this chapter discusses how the moisture leaves the wood, knowledge of which is fundamental to an understanding of the seasoning process.

The seasoning of wood is nothing more than the removal of the major portion of the moisture it contains, and all the difficulties encountered by the lumber drier may be laid to the behavior of the wood as it is deprived of this moisture. In Chapter III the authors explain what is meant by "sap" or moisture content, how it is determined and the instruments required, what the fibre saturation point is and its significance, the effect of moisture and drying on the properties of wood, etc. Chapter IV is devoted to the manifestations of internal adjustments to the strains set up during drying, shrinkage, swelling, or more specifically, cupping, warping, twisting, checking, caseharden-ing, honeycombing, and collapse. Perusal of the first four chapters

will shock many wise "old-timers" by destroying some of their pet ideas or beliefs of what actually goes on in a board as it dries. These chapters are applicable to air drying as well as to kiln drying.

Chapter V begins the actual consideration of kiln drying practice, with a discussion of types of dry kilns. Commercial kiln makers and their salesmen have done much to confuse the prospective purchaser of a kiln as to the features that make one kiln different from another and the significance of these differences. Koehler & Thelen make a principal classification on the basis of operation—progressive kilns and compartment kilns. Another classification is based on the control of humidity, giving the ventilating and the condensing types. A third classification is on the basis of circulation and gives the natural-draught and the forced-draught types. Each type is fully described and their relative merits and applications discussed. Advantage is taken of the many excellent cut-away illustrations of dry kiln makers and of line drawings to illustrate the types. Closing this chapter is a detailed description of 18 commercial kilns including the Tiemann water spray kiln and the reversible circulation kiln of Thelen's, both developed at the Forest Products Laboratory.

To obtain good results from the use of kilns, there must be correct control of three conditions—heat, humidity, and circulation. To each is devoted a chapter. The function of each is fully discussed as well as is their control. These chapters also give an opportunity for describing and picturing the numerous details of kiln appointment and accessories—the banks of coils in a number of different arrangements, valves, traps, thermometers, thermostats, hygrometers, blowers, and others, each in a number of types. The authors did well here again to make free use of the excellent illustrations of the manufacturers of the various instruments.

Since the method of piling so intimately affects circulation, it was logical to go into this matter very fully in the chapter devoted to circulation. In this section the illustrations No. 92 and No. 94 picturing automatic stacking and a special rack car for stave drying are not particularly illustrative; automatic stacking might well have been more fully illustrated.

Chapter IX is a very important one. No matter how well an operator appreciates the principles of drying he can not achieve good results if he selects or builds his kilns improperly. Too many lumber establishments in an effort to save money turn over the design, layout, and construction of their kilns to some handy-man about the plant.

The finished kilns are seldom as cheap as anticipated and more seldom are they productive of good results in drying the lumber. In this chapter, one of the lengthiest in the book, the authors call attention to a number of points that must be considered or observed in the selection, location and layout, and the construction of single or batteries of kilns. A very careful study of this chapter by the prospective builder of kilns will help him to avoid the many mistakes that are not manifested until actual operation of the kilns is attempted. This chapter alone is worth the price of the book and is really worthy of separate publication and wide distribution.

Chapter X is principally for the operator in that it describes the details of conducting the drying operations, the use, care and calibration of the instruments, selection and placing of the samples, tests during a run, keeping the records and making up schedules.

This book is a development from a series of mimeographed lessons prepared by the senior author for use in a correspondence course on the kiln drying of lumber offered by the Extension Division of the University of Wisconsin. It can not be classed as a highly scientific book; it could not have been intended as such; but it is eminently practical, thus highly and immediately useful to the man at the kilns. Happily, it is not superficial, as each factor of importance in drying is given adequate treatment.

—E. F.

"A Study of the Mycorrhiza of Abies firma, S. et Z., with special reference to its Mycorrhizal Fungus, Cantharellus floccosus, Schw. By Koki Masui. Memoirs of The College of Science, Kyoto Imperial University, Series B, Vol. II, 15:84, Pl. 2-5, 1926.

"On the Renewed Growth of the Mycorrhizal Root." By Koki Masui. Memoirs of the College of Science, Kyoto Imperial University, Series B, Vol. II, 85:92, Pl. 6, 1926.

For some reason or other, the mycorrhiza of forest trees have received but little attention, not only from foresters but from botanists as well. It is very gratifying, therefore, to find a really quite comprehensive paper on this subject.

There are two schools of thought regarding mycorrhizal fungi. One considers that the fungi which are the cause of ectotrophic mycorrhiza are symbiotic with the root of the higher plant. This conception was first advanced by Frank in 1885 and has been supported by numerous later investigators. The other considers these fungi to be parasitic in nature and that the tree does not benefit in the least and

may actually be harmed by the relationship. This conception has been supported by Woronin, Weyland, McDougall and others.

The author could find no evidence of any symbiotic relation between the roots of *Abies firma* and *Cantharellus floccosus*. On the contrary his data clearly indicate that the fungus is parasitic in nature. This conclusion was reached after careful field observations and after a detailed histological and microchemical study of the mycorrhiza. As a matter of fact, infected roots are eventually killed by the fungus.

Any one contemplating a study of the mycorrhiza of forest trees will find Masui's paper very interesting and instructive. It will be found particularly helpful in that the methods of approach to the problem are carefully worked out and discussed in considerable detail, and because of the fact that a rather complete bibliography is appended.

In the previous paper, Masui reports the fact that the roots of *Abies firma* are eventually killed by the mycorrhizal fungus, *Cantharellus floccosus*. The time required, however, to complete the process varies. If the infected root is in a weakened condition, it can not continue to grow after the completion of the fungous mantle. This is perhaps the most general case. If, on the other hand, the root is still vigorous, the mantle may be split and the root tip push through only to again become completely surrounded by the fungus and in most cases eventually overcome.

—H. S.

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NOTES

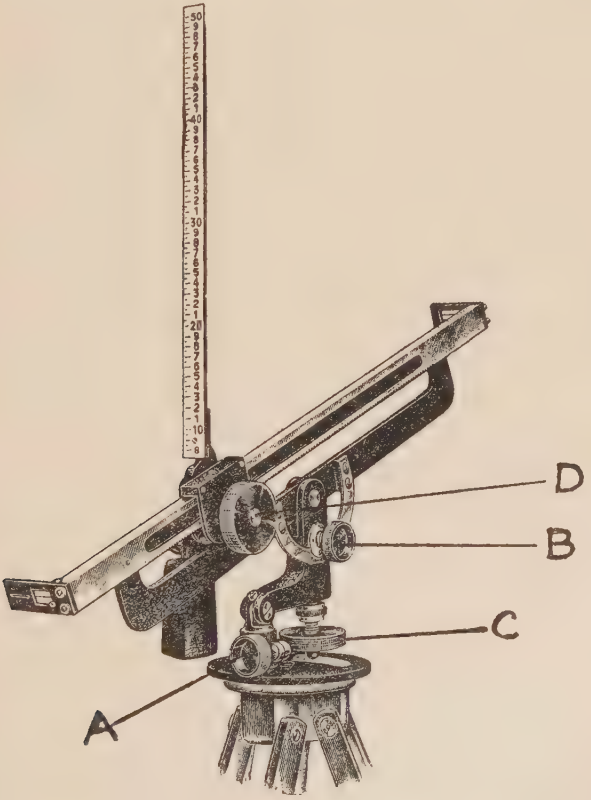
The Büchi Hypsometer.*

In an attempt to get away from the necessity of measuring a base-line when taking heights a new hypsometer has been developed by E. F. Büchi & Söhne of Bern, Switzerland. Objection has been made that the use of a tape is troublesome and time-consuming in broken topography and dense stands, as the popularity of the Christen hypsometer bears witness. All such instruments require the use of a long pole which is held against the tree, and the accuracy of the Christen instrument is rather low, even in experienced hands, errors increasing rapidly with tree height. Thus an error in 2 mm. on the scale may incur an error of 4 meters when measuring a 30 meter tree. An instrument known as Hüni's hypsometer, described on page 154 of Müller's Holzmesskunde (3rd ed., 1923) was more accurate, but heavy and slow to operate. The new hypsometer is based on the same principle as Hüni's, but is claimed to be lighter, more compact, and quicker to use. It was first exhibited at the Swiss Exposition of Agriculture, Forestry and Horticulture at Bern in the summer of 1925. It is manufactured and sold by E. F. Büchi & Söhne, Spitalgasse 18, Bern, Switzerland. The price quoted in 1926 in response to an inquiry from the writer was 150 Swiss francs (about $28.87) complete with tripod.

The instrument consists of a vertical scale, pivoted at the lower quarter of its length, and provided with a weight at its base, functioning as a pendulum, much as in the Klaussner hypsometer. This slides by a rack and pinion on an adjustable arm, carrying two sights. The pendulum scale also carries a sight on its lower end. The scale is graduated to the nearest meter only, but it has been found possible to estimate to 10ths (decimeters) with reasonable accuracy. The instrument rests upon a metal plate which is fastened to the tripod, the attachment being pivoted for vertical aiming within a small arc, and also for fine adjustment of elevation by means of a leveling screw. Rough adjustment of the sighting bar is accomplished by clamping the arc with the thumbscrew B. In using the instrument no base-line is measured, but a 4-meter pole is required, which is propped up, or better held by an assistant at the foot of the tree. The tripod is roughly leveled at a convenient distance from the tree, and the sighting bar directed as nearly as possible at the pole. Accurate adjustment

*Based largely on an article by Dr. Hermann Knuchel: Ein neuer höhenmesser, Schweizerische Zeitschrift für Forstwesen, No. 10, 1925.

of direction is then made by swinging the instrument on its base pivot, and screw A is made fast. Similarly, the sighting bar is brought in line with the top of the pole, first by loosening screw B and swinging the bar, and then by screw C as in leveling up a transit. The pendulum scale is now racked out by means of the screw D until the sight hole in its lower end (not visible in the illustration) cuts the lower end of the pole. The eye is now directed upward to the top of the tree, and the point on the scale where the cross hair intersects is read off direct-



ly as the tree height. Best results are secured if the eye is held about one foot from the sight in the latter instance.

Tests made of the instrument by Prof. Knuchel showed an error of but .5 per cent as compared with accurate trigonometric determinations using a transit. Since all the errors were negative, it would seem that a correction factor could be applied if desired, but the ac-

curacy is such that the errors can be ignored in practice. Although the hypsometer is designed for general forestry practice, the necessity of using a tripod makes it share the same disadvantage of the Klaussner, i. e., slowness of set-up and difficulty of transport. Its cost and more or less complicated and delicate structure will also tend to restrict its use. As for the advantage claimed for the use of a staff instead of a measured base-line, it is doubtful if this will meet with favor under American conditions. Experience of the writer in using Christen's hypsometer in northern New England has convinced him that it is much more troublesome to carry a ten to sixteen-foot pole in the woods than a tape; with the former an assistant is almost necessary, while reasonably rapid work can be accomplished alone with the Faustmann or Forest Service hypsometer, using an improvised "one-man" tape, consisting of a sharp hook attached to the zero end of a common cloth roll-tape, which can be hooked into the trunk of the tree. For work where great accuracy is desirable, as in the measurement of permanent sample plots, Büchi's hypsometer has considerable merit, and appears to meet the requirements for accuracy with more convenience than any other apparatus heretofore developed.

HENRY I. BALDWIN

What is Wrong with Our Forestry Propaganda?

Editor, Journal of Forestry:

Sir—

In regard to the first page of the April number of the Journal of Forestry:

Our propaganda is unsound for two reasons:

Because it is generalized and not specific. Doctors don't cure by proclamation.

Because many of the silvicultural methods proposed are financially unsound. A business must yield profits.

Public acquisition of areas valuable for recreation is progressing well. But for timber production, protection against fires and intensive utilization are about all that amount to anything, at present. Generally speaking, trees can be grown cheaper by adequate fire protection than in any other way, and can not be grown without it.

The profession is not a unit in its aims. Do we know what we want? To me, it seems that we have never made an adequate attempt to get sufficient protection against fires by co-operation between private owners and the state and federal governments, varied as local needs

might require. In the face of millions of acres burned annually, we are trying to produce timber by the paternalism of government acquisition of fractions of our forest area and by theoretical propaganda. And demonstration areas seldom illustrate financially practical methods.

The public has not yet been taught that forest fires are chronic, and nine people out of ten, talking about forestry, will ask about progress in "reforestation," whatever that is. The public seldom asks about progress in protection, and the legislator does not appropriate much money for it either.

The state which allows thousands of acres to be burned over annually is functioning weakly as a government, in an obvious and practical duty,—as much so as is the maintenance of a good fire department the duty of a city. The first business of the public forestry office should be staunch protection of forests, the last business should be theoretical propaganda, or engaging in the timber business itself.

This is not saying that protection against fire is everywhere the most essential matter. Vermont, with a low fire risk, is undoubtedly wise in encouraging farmers to plant, and Michigan, with but little growth worth protecting at all, is undoubtedly wise in trying to establish something worth protecting, but for the nation, protection of mature timber in Oregon or Minnesota, is far more essential and business-like than worrying about planting on Vermont farms or Michigan sand.

Whether we like it or not, we are up against the same spirit of carelessness and lawlessness common to American life. The forestry books don't tell about it. European countries do not have this risk, and with better markets and cheaper labor, intensive silviculture has paid both on public and private lands. If we must imitate Europe, why not get our governments to enforce their laws and protect property? If we can not stop fires, we may as well continue about as we are, and be satisfied, buying what land we can for public ownership, talking, etc., but I doubt if we shall produce much timber thereby. It is true that in practical politics we must generally accept what the legislatures and Congress give us, and make the most of it,—but the question is, what are we going to ask for, and ask for persistently enough to be heard.

P. T. Coolidge

April 24, 1926.

Reed Analyzes the Situation

Editor of the Journal,

Sir—

The foreword in the April issue of the Journal entitled "Forest Propaganda and Forestry" has attracted my attention. My first impulse is to reason thusly:

To be sure, there have been far more words than deeds and a great deal more discussion of what should be done than actual work itself, but this, if one analyzes the situation, proves to be perfectly logical.

Forestry still is primarily a species of political propaganda rather than a profession, and those who have succeeded in it, who have attained the high places, and won the broadest fame, are those who have talked the best and written the most.

There is indeed much work to be done in the woods, always has been, and always will be. There is much fire to prevent; there are many problems in silviculture, management, and utilization to be worked out and applied. There always have been, are now, and always will be some misguided souls actually devoting themselves to this real work. They have been so busy, however, doing real things in the woods that they have had no time to stop and tell the world about it. Everybody else has been so busy telling the world what ought to be done that there has been no time to tell what is being done, nor to give due recognition to the men who are doing it. The doer, therefore, remains comparatively unknown, unappreciated and unrewarded.

The result is inevitable and logical. The average young American in choosing his career, who is attracted by the forestry propaganda and convinced that this is his field of life work, is, as a rule, practical and ambitious to rise to the top. As he progresses in his studies, and later branches out into the field of real endeavor, he begins to realize that words pay better than deeds and guides himself accordingly. He recognizes, of course, that real work is good and is necessary, but, like all good practical Americans, he prefers doing the things which pay the best rather than those things which are the most useful. He, therefore, devotes himself to the development of the silver tongue and the facile pen, retaining from his silviculture, his dendrology, and other sciences only such technical terms as will lend savor to his oratory and his essays. If he is at all able, his advancement is then assured and he can look forward to a life of ease in a city, intermingled with banquets and a dinner coat, where he will be acclaimed as a great forester and rewarded

with high position and high salary, that is, as high as salaries in forestry go.

In the meantime, your doer in forestry, who, through lack of common sense, has stayed out in the woods where the trees grow, and has devoted himself to making them grow faster, must be contented with a modest position, low rate of pay, and with eating his dinner in a flannel shirt off of a tin plate. As long as human nature remains such as it is, conditions will remain such as they are. It will continue to pay better to talk forestry rather than to practice, and the more pracical members of the profession will specialize in language rather than in deeds. Any man who does otherwise will be neglecting his own best interests.

Such talk is the mark of a cynic; one filled with green-eyed envy of those who have succeeded where he has failed. He should take a tonic for his torpid liver and try again. My second impulse is to reason more like this:

After all is said and done, the fact remains that propaganda still is the most important phase of forestry, and it still is necessary to do a whole lot of talking and writing to attract and hold the interest of the dear public, for the support of much needed legislation and appropriations, and to induce some of the said dear ones to consider seriously the investment of their own private funds in timber-growing ventures.

Isn't it good, therefore, that Women's Clubs, Rotarians, Kiwanians, hundreds of civic clubs of every description, Waltonians, sportsmen, nature lovers, lumbermen, school teachers, newspapers, and realtors, as well as the foresters themselves are all talking forestry? Isn't it important, too, that the foresters themselves continue in the lead of the movement? And that the best talent in the profession devote itself to the spread of the gospel?

Assuming the answer to be "Yes," it is logical and right that ability to talk and to write should for the time being at least be in greater demand than detailed silvicultural knowledge and should command greater reward in the way of place and pay. It is equally logical that members of the profession should be more interested in developing their talent for public speaking and for writing than in the actual job of making more and better trees grow faster.

While the apparent result, as your foreword infers, is that, in spite of all the talk, there is too little actual accomplishment, still one should not be too hasty in his conclusions.

My own recent experiences and contacts lead me to believe that there is more real progress in the better management of timber lands than can be seen through the dense smoke screen of propaganda. One must get down to earth and view the situation at close range, not from the high eminence of an oratorical platform.

If one does this, he can find localities where the fire risk has been reduced to the point that it no longer is an obstacle to the business of raising timber. He can find places where the immature second growth is being recognized as having a definite commercial value and where the land owner realizes that it will reach merchantable size soon enough to justify him in holding his property. He can find instances where capital has bought timber-growing land in the confidence that the growth of the timber will pay satisfactory dividends on the investment.

He can find regions where a few years ago forest fires all over the mountains every year were calmly accepted and passed unnoticed as an inevitable part of the general scheme of things, but where today one fire of any moment is front page stuff for the newspapers, and calls out volunteers from all walks of life to subdue it. Credit for this progress is due in no small degree to the smoke screen of propaganda. The flood of glittering generalities that has drenched the land for the past twenty-five years is having its effect, and is getting results that call for keeping it up on even a larger and better scale.

One cannot, of course, measure the profits from advertising by any definite calculation in dollars and cents. Thousands of people touring our highways every summer read about the school-girl complexion and the cigarette one would walk a mile for, without ever putting any soap at all on their face, or even borrowing a Camel from their dearest friend, but there are enough who do stop, read, and then buy, to justify the Palmolive Company, and the R. J. Reynolds Tobacco Company, and such like to expend millions in the adornment of our roadsides with fancy colored billboards.

When a new article of consumption is first put on the market advertising costs exceed production costs. In spite of all that can be said, forestry, and all that it means, is still a new thing in this fair country of ours and therefore for some time to come much effort and money must be devoted to telling the world about it, and the relation between advertising and producing must continue to be apparently out of proportion. Gradually as we establish our market the ratio between talk and deeds will rectify itself. The demand for men who can make the trees grow will steadily increase, and with it the reward for their

service, until the time comes when the best talent in the profession will be attracted away from the lecture hall, into the woods. Then—even then, I suppose, the pessimist, he of the torpid liver, envious of the success of others, will still be kicking about the situation.

Having thus ably established that the present volume of forest propaganda is right and that it should be increased, perhaps one should consider in detail the methods and kinds, and whether new lines of attack would get better results and get them quicker.

The present line is good, insofar as public forestry is concerned. It is proving successful in arousing the public consciousness to the benefits and needs of fire control, and of publicly owned forests.

As to private forestry, however, it is weak and has proved less successful because it has paid too little attention to the financial phases of the situation. It has not always recognized that to the business man, the lumberman, the paper manufacturer, or the capitalist looking for an investment, the proposition to own land and grow trees, is strictly a business proposition to be measured strictly on a dollars and cents basis; that the factors of rate of growth, and sale value must balance against the cost factors, of initial investment price, and annual carrying charges, such as interest, protection and taxes, in such a way as to give assurance of a profit equal at least to that promised by other opportunities with the same degree of risk. It has not always recognized that of all the land which should, for public benefit, be kept under forest, probably less than fifty per cent will grow timber fast enough and at a cost to insure adequate dividends.

The public, when it invests in a forest property, can forego cash dividends to the extent that it derives public benefits through its ownership. Private capital must take all of its dividends out in cash, and must get them at frequent and regular intervals.

These principles, the publicly paid forest propagandist is prone to forget. When he is asked to advise the lumberman if it would pay to hold his cut-over land for a second crop, he is apt to think first of the public benefits which would accrue, and then to muster every possible argument in favor of the proposition, and to forget the factors against it. He is inclined, too, to reason that, because it paid the lumberman to buy the land for the purpose of harvesting the virgin crop, it will pay him also to hold it and grow a second crop. He does this with too little regard for the financial phases of the situation and consequently his conclusions are too apt to be wrong.

The result is that when one comes down to a specific case, the opinion and advice of the publicly paid forest propagandist is unreliable and is given little weight.

It would be better, in preaching the gospel and spreading the propaganda, if the difference between public ownership of forests, and private timber growing investments could be more clearly recognized; that the one is based on broad economic principles and consideration for the general public welfare, and that the other is a problem in sound finance. It would help further if it could be more clearly recognized that mere accident of ownership does not necessarily make a good timber growing investment, that of all the millions of acres which will grow trees, and which, for the public good, should be kept in forest, probably not over fifty per cent will produce fast enough, or cheaply enough, to permit private capital to hold it. It would help still more if the forest propagandist, when asked for advice whether a specific tract would pay dividends by the growth of its timber, would give more heed to the financial aspects of the case, and not allow himself to be prejudiced by the public welfare idea.

At the last meeting of the Washington Section of the Society two able papers were presented on the financial phases of forestry as an investment. One was by Mr. Chandler of the Timber Section, Federal Income Tax, and the other by Mr. M. L. Rue of Benedict and Rue, Forest Engineers, of this city. They each treated the subject from a different angle, and both papers are well worth study by the professional forest propagandist.

When I get time, I shall write something on the subject myself.

F. W. Reed,
Executive Secretary, Joint Committee on Recreational Survey of Federal Lands.

Danish Forest Associations

Danish forest owners with holdings of less than 50 hectares during the last few years have formed what is known as "Small Holders' Forest Associations." These associations, of which at present there are six in existence, with the assistance of the state government, each engage a trained forester to advise and assist them in connection with forest problems. The Forester's duties consist in advising and assisting in such matters as cutting, thinning, and planting, and he also usually advises and assists in connection with purchases of trees and in the sorting and sale of lumber. In addition, the associations usually

arrange for educational meetings and excursions but in contrast to the educational forestry work carried on in the United States the guiding principle of the activity of the associations and the foresters is to provide technical service rather than to educate, with self-sufficiency of the forest owners, as the final goal.

The state government, as mentioned, gives financial assistance to the employment by Forest Associations of trained foresters, in accordance with the Law of March 1, 1919. This Law provides for a maximum grant of 2,000 crowns per year toward the employment of a Forester by associations of forest owners whose holdings do not exceed 50 hectares.

The fees of the associations are very small. The annual fee averages two crowns for holdings under six hectares and 4 crowns for holdings of between 6 and 50 hectares. The service of the Forester is usually paid for at the rate of about 2 crowns per hectare, of which the state pays one-half.

In addition to the above discussed activities, the so-called Plantation Association (Hedeselskabet), an association of larger and smaller owners of cultivated pine and fir plantations, which also receives state aid, carries on a work of considerable proportions in assisting its members along the same lines as outlined above.

H. Sorensen
Commercial Attache.

Mauricio J. Oteyza

Mauricio J. Oteyza was born in Manila on October 18, 1886. He received his early education in the Ateneo de Manila and later became a teacher for one and a half years. In 1908, he was one of the student pensionados sent from the Philippine Islands to the United States, where he enrolled in the Kansas State Agricultural College, graduating in 1910 with the degree of Bachelor of Science in Agriculture. Later he attended the Yale School of Forestry, where he graduated in 1911 with the degree of Master of Forestry.

Upon his return to the Philippines in that year he was appointed Assistant Forester in the Bureau of Forestry and on February 1, 1917, he was made Forester holding various positions of high responsibility in the Bureau of Forestry until his retirement from the service on account of ill-health on July 3, 1924. Since he retired, he had been attending to his private property in Baguio, Mt. Province, where he died from tuberculosis on February 5, 1926. He is survived by his wife and two children, named Victor and Virginia.

As Forester, Mr. Mauricio J. Oteyza was a staunch supporter of forest conservation. He was the first Filipino forester to prepare a working plan, and his plan for the Baguio pine forest with the idea of conserving it will always be a living example to foresters in the Philippine Islands.

Mr. Mauricio J. Oteyza died with forestry and thought of his colleagues at heart. His telegram to the Director of Forestry, Manila, received shortly before he died on February 5, 1926, shows his kind nature.

> "Good-by, Fisch. I am going ahead of you. Thank you for all your kindliness to us. Tell good-by for me to everyone of our men and to every Forester I know in the United States. God bless you, my brother and friend.
>
> (Sgd.) MAURICIO J. OTEYZA."

The death of Forester Oteyza is keenly felt by every member of the Philippines Bureau of Forestry. Although he had been out of active service, yet he had always been of great value to the bureau in rendering illuminating opinion on important forestry problems referred to him.

SOCIETY AFFAIRS

Greater Movie Season

Mr. Will H. Hays, April 19, 1926.
President, Motion Picture Producers
and Distributors of America,
469 Fifth Avenue,
New York City.

My dear Mr. Hays:

Your letter of April 12, to President Dana of this Society who is now in Europe, has been referred to me.

I have no hesitation on behalf of the Society of American Foresters in endorsing Greater Movie Season and assuring all consistent co-operation. The good which can be done through the showing of motion pictures of a high order is beyond estimation.

We can tender our endorsement the more heartily and gladly since we have but very recently read a copy of a resolution passed December 31, 1925, by the Directors of your organization which places the Motion Picture Producers and Distributors very definitely on record in favor of the reforestation movement in the United States.

I sincerely trust that all success will attend the celebration of your thirtieth anniversary.

Very sincerely yours,
PAUL G. REDINGTON,
Acting President.

A Suggestion For Getting Data Printed

Valuable data for foresters is scattered through numerous books and bulletins from various sources. Publications may be out of print, sizes vary, tables are scattered through text or data for several regions may be grouped together. Tabular information is withheld until bulletins can be published, or is issued in mimeograph. Our need is to get information of value, especially tabular data for field use promptly and in convenient form.

Since there is now a publisher who prints hundreds of technical data sheets and blank forms at a popular size for sale, there is an opportunity for us to get what we want at low cost. In addition there would be the advantage of compiling note books with the commonly used data sheets and blank forms to cover separate phases of work or seasonal projects. Less frequently used data sheets may be filed.

The writer suggests that a permanent committee be appointed to arrange with the Lefax Company for publication of material on forestry which it has selected and arranged. Other organizations have sponsored some data for publication by this company, but no technical society has made systematic plans for publishing the material in its field in this manner. The advantage is mutual, foresters could secure reliable information in convenient form; the publishers would extend their business and have the assistance and advice of the committee on what to print.

Such a committee should be composed of men in various phases of work, one from the Forest Products Laboratory, one from the Forest Experiment Stations, etc., and should select for printing information for which there would be considerable demand. Perhaps annual or semi-annual publication of sets of data sheets would permit the inclusion of some sheets which would not otherwise justify publication. It would also be the duty of such a committee to get out the results of current research as promptly as possible. All sheets should bear a mark or notation to show that they were sponsored by the society.

F. G. Wilson

Charles Lathrop Pack Forestry Prize

The Charles Lathrop Pack prize is the gift of Mr. Pack to the Society of American Foresters to be awarded under conditions determined upon by the Society. The prize is in the amount of $500 annually for the two years 1925 and 1926. The award for 1926 will be made at the end of the year and will be announced at the annual meeting of the Society. The Executive Council has decided that the prize shall be for a professional article and has left the details to a special committee. The committee has outlined the following conditions:

The prize for 1926 shall be awarded for the paper which makes the largest contribution to the advancement of forestry. In judging the papers submitted, the committee will consider the character, scope, and originality of the subject matter, the effectiveness of the presentation both to foresters and to non-technical readers, and the value for the general object, namely the advance of forestry. Papers should not exceed 10,000 words in length and may include illustrations if necessary. The manuscript must be typewritten and submitted in triplicate, if possible, to the chairman of the committee, *Joseph Kittredge, Jr., Lake States Forest Experiment Station, University Farm, St. Paul, Minn.,* on or before November 1, 1926. A manuscript should not be signed,

but the author should write the title of his paper, his name, and address on a separate sheet which he should place in a sealed envelope labelled "Author's name," and enclosed with the manuscript.

The competition is open to all Associate Members, Members, Senior Members, and Fellows of the Society of American Foresters in good standing.

The Society reserves the right to withhold the prize if in the judgment of the committee, an award is not justified.

Committee on Charles Lathrop Pack Prize:

J. KITTREDGE, JR., *Chairman*
E. O. SIECKE
ALDO LEOPOLD

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CONTENTS